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Shall Justice Be Denied to the Public Utility Companies?

ADDISON it was who voiced the sentiment that "there is no virtue so truly great and godlike as justice," and while there are some who despair of ever attaining it on this earth, justice does exist, even though it may move with tardy pace. Now, society has set up tribunals for the administration of justice known as courts. There the high and low, rich and poor, may plead their cause and be assured of righteous judgment, and on that foundation civil society rests.

Why, then, should stumbling blocks be placed in the pathway of justice when it concerns public utility companies? Wherein are they different from other individuals or corporations? The mere fact that they are clothed with a public interest and hence subject to public regulation does not deprive them of the right to appeal to the courts, as Governor Moore of New Jersey proposes. Public service commissions are endowed by the states possessing them with legislative, not judicial, functions. It is for them to regulate the rates charged by public utility companies and to pass on the quality of the service rendered. It is for the courts to decide whether those rates are just, and when a governor of a sovereign state asks that justice be limited and even withheld until a body having no judicial functions shall act he impugns the courts, denies justice and, without intending it, strikes a blow at democratic institutions. When utility companies, or any one else, appeal to the courts, they do it for justice. Never has it happened in this country, except in periods of great stress, that justice has been denied, and it is doubtful if Congress will so far forget itself as to shut the door of federal courts to public utility companies now; because Congress knows that no such covenant will stand.

Wider Market for Utility Bonds

AS THE requirements of public utility companies increase and multiply it is obvious that, with only a limited supply of money available, their wants become more difficult to supply. For that reason the effort being made by the Savings Banks Association of New York to induce the New York Legislature to change the savings banks law so that bonds of certain selected utility companies may be deemed legal investments for savings banks is both opportune and interesting. The bill now before the Legislature does not mean that the standards set for savings banks investments will be lowered—heaven forbid! but that 30 per cent of the resources of New York savings banks, or $1,200,000,000, may be invested in some kind of legal bond more liquid than mortgages, or held in cash or on deposit in other banks. Half of this proportion, or 15 per cent of its assets, may by the terms of the bill be invested by any savings bank in the bonds of qualified gas or electric companies, not more than 5 per cent in the bonds of any one corporation.

A reading of the bill reveals that the standards set for utility bonds are higher than those for legal railroad bonds, so that not many public utility securities will qualify. However, to have the savings banks of New York move to include properly safeguarded public utility bonds among their legal investments is indeed a high tribute to their worth and an added assurance that well managed and conservatively financed utilities shall not lack funds for their proper development and expansion. Savings banks also render in this way an additional service to the community. Seventy per cent of their resources are already available for investment in first mortgages, preferably on small homes, and if the proposed bill is enacted into law, some of the 30 per cent remaining will be available to render those homes habitable and comfortable.

Dielectric Theories and Absorption

MUCH interest was manifested in the session of the A. I. E. E. midwinter convention which dealt with dielectric absorption and theories. Three important papers were presented, two of them being in the range of theory and one reporting the results of experiment. Of the two former, that by Dr. Whitehead constituted a report of the committee on insulation to the division of engineering and industrial research of the National Research Council. It will be recalled that this committee was formed, first, for the purpose of reviewing the widely scattered literature on the subjects of dielectrics and insulation and, second, as based on such a review, to propose definite lines for further investigation and research.

Dr. Whitehead's paper is a compact and comprehensive review of the experimental facts in connection with dielectric absorption and the theories that have been advanced to account for it. It constitutes a valuable addition to the literature of the subject and with its bibliography is certain to be of great assistance to all future workers in this field. It is difficult, and perhaps unwise, to single out any particular conclusions from this extensive review, but it is of interest to note that it points out that Maxwell's theory of dielectric absorption, which is based only on the fundamental properties of conduction and specific inductive capacity and therefore involves no new assumption, is the most satisfactory and has a firmer experimental basis than any other theory; further, that for ordinary temperatures the alternating losses in composite dielectrics may be explained in very satisfactory manner as based on the phenomena of dielectric absorption. In the report the idea of hysteresis, in the magnetic sense, as an explanation of dielectric loss is shown to be unsuitable, if not quite erroneous.

Professor Karapetoff's paper dealt with the highly complex question of the variation of the shape of the absorption current curve of a dielectric from the simple forms indicated in Maxwell's and other theories. It attempts to account for these variations by the in-

troduction of additional constants of the material, with the suggestion that these different constants may arise within the atom of the material and with regular forms of distribution. In this he has followed the methods of von Schweidler and K. W. Wagner, but his mathematics are clearer, and he suggests methods in which these highly complex theories may be tested experimentally. Professor Dawes presented a number of interesting results on the influence of ionization in entrapped air spaces and cables, with its effect on power factor, loss and capacity. The results agree in general with those that have been observed before, but extend greatly the range of observation and bring out peculiarities of impregnated paper insulation which have not been recognized before. The discussion emphasized the fact that if ionization is allowed to go on continuously in cables it is certain to lead to continually increasing power factor, loss and deterioration. The session in question, including papers and discussion, has undoubtedly added substantial knowledge on the intricate question of the behavior and the reliability of composite insulation.

Transmission Stability

THE most difficult part of the problem of transmission stability is the determination of the numerical value of the parameters of stability in particular cases, and especially for the pendulum action or the tendency to overswing when a change of load in a system requires a new position of equilibrium. The principles involved are now well understood, and at least one analytical and one electrical analogue method have been proposed. These, however, are merely methods of overcoming the mathematical difficulties of the solution and still leave untouched the difficulty of properly evaluating the factors of losses and damper currents.

Experience has shown that any damper current set up by an advance or retreat in the position of the rotor in regard to the revolving field of the stator will tend to reduce, temporarily, the forces driving the rotor toward its new position of equilibrium, and, similarly, if the rotor overshoots, these damper currents tend to restrain the overswing. If these forces are sufficiently powerful, they may render the swing of the rotor deadbeat. The conditions governing the effect of these damper currents, which are usually of very low frequency, should be fully studied to see what can be done in order to restrain the overswing. These damper currents should be controlled by the damper resistance rather than the reactance, but, subject to this limitation, the damper resistance should apparently be as low as possible. The field winding, having by far the greatest weight of copper surrounding the field poles, would naturally have the most effective damper action.

While our present knowledge and understanding of system stability is entirely logical, there is an ultimate need of something more, namely, a standard test to be satisfied by any particular system to insure reasonable continuity of service. It may be too soon to offer such a test or criterion for actual adoption, but something definite in the nature of an overload that can be taken and sustained at a certain power factor or a drop in voltage without making the system fall out of step will be required. It is gratifying that so much has been done to render the terminal apparatus of the system more responsive to its duties. Still more is, however, desirable, and no doubt possible, on account of the dominating importance of the cost of the line as compared with the cost of regulating and exciting apparatus.

Lighting Service Department Activity

ONE of the most important and profitable developments on the commercial side of the central-station industry has been the lighting service department. A few years ago there were very few such departments in this country. Now there are a great many and the number is rapidly growing. They vary in size from those using the part time of one man to others requiring the entire time of two dozen men. Just as the name implies, they are best organized first for the purpose of giving authentic lighting advice. Surely this must be the basis of the service. Increased business from better lighting, from campaigns, from lighting equipment, etc., is bound to follow a sound lighting service.

Recognizing that the so-called lighting service department should primarily be established upon a sound knowledge of proper lighting practice, the Illuminating Engineering Society invited some of the leading lighting service men to hold a meeting in connection with its annual convention in Detroit. This meeting was attended by sixty-five lighting service men from central-station companies, and it was highly successful. Recently another step has been taken by this society in organizing a lighting service committee under the leadership of successful central-station men. This committee becomes a forum for the interchange of ideas and also has begun very actively the preparation of an elaborate lighting service department manual. Surely a new era of lighting development has begun in earnest in the central-station industry.

High-Voltage Air Condensers

IN ONE of the papers of the recent midwinter convention of the American Institute of Electrical Engineers the statement was made that a high-voltage air condenser was found to have a considerable phase difference or power factor. No explanation of the origin of the loss that would be occasioned thereby was offered, and several speakers in the discussion expressed surprise at the value given.

It has generally been assumed that a properly constructed air condenser has zero power factor, and such condensers are widely used, in bridge and other methods, in the measurement of power factor of solid and composite insulation of a wide variety of character. It has been pointed out by those who have worked with such condensers that in order to take advantage of the supposed zero power factor care must be exercised that none of the insulating supports of the low-voltage plate shall be subject to electric stress, inasmuch as such supports always do have some phase difference and therefore may introduce error into the observations. Further, it is obvious that if there are any sources from which brush discharge may take place, either in the condenser or in the neighborhood, the air may take up a certain conductivity, thus leading to a power factor for the condenser other than zero. It has been generally thought, however, that if precautions are taken to avoid these obvious errors, the power factor will be very close indeed to zero. In fact,

reports of certain experiments by German workers indicate that for low-voltage parallel-plate air condensers the power factor has been found to be zero, in a bridge method capable of detecting a phase difference as low as two seconds of arc.

The only possible source of power factor in an air condenser properly constructed would appear to be the natural ionization always to be found in the air. There is obviously some uncertainty as to the magnitude of the error introduced on this account. It may be definitely stated, however, that the power factor so caused is negligible for practical purposes. The normal ionization of the air is about 2,000 ions per cubic centimeter. The charge on an ion, however, is so small that the current due to this ionization is negligibly small. Based on these figures, and for time values pertaining to commercial frequencies, it was shown at the meeting in question that the power factor of a typical high-voltage condenser with 2-in. separation between plates could not exceed 0.000004. Discussion of this character therefore indicated that the use of high-voltage condensers for measuring purposes is permissible with the assumption of zero power factor.

"Cross-Sectioning" the Electric Range Load

RECENT inquiries about the economic results of electric range service disclose a surprising lack of data in central-station files in territories where better things would be justified by the prosperity of the companies in general. Even where vigorous commercial development of electric cooking has been under way for several years it is often hard to secure such elementary information as the number of ranges installed and their connected load, to say nothing of the demand and energy consumption of these units, the total cost of supplying energy for cooking and water heating, the sums paid monthly by users for this service as distinguished from other domestic applications, and the prorated capital charges the electric range business imposes upon the utility. The time has arrived for greater activity in this direction.

Too many central-station managers have been content to await the results of the comprehensive investigations of the N. E. L. A. range committee, soon to be made generally known. If these results were lying on every manager's desk today, the incentive would remain to check local range situations and possibilities against the national committee's findings and to determine whether anything like full use of opportunities to build this class of business is being made. In the meantime why not get into action on local properties and ascertain what this kind of service signifies economically in specific cases?

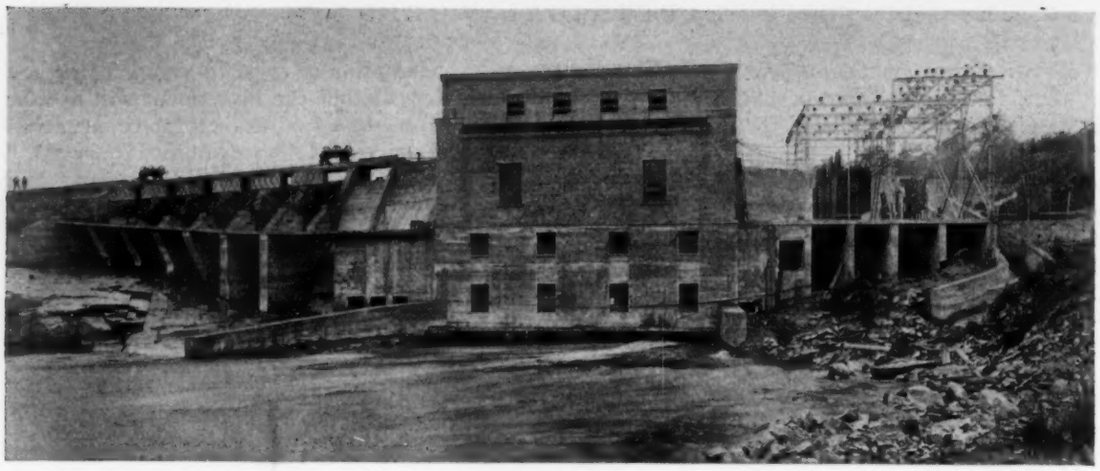
The industry needs more analyses of the type conducted by the Narragansett company of Providence not long ago and published in the ELECTRICAL WORLD for April 25, 1925. Commercial managers and executives who overlooked this article—and some did—will do well to study and apply its methods to their own cases, modifying these as required by local conditions, above all, getting significant information to guide their own procedure in load building through electric cooking. It will be necessary perhaps to spend some extra money on recording instruments to show the demand and energy consumption of selected groups of ranges at stated time intervals, but the investment will be of permanent value. Here is a real chance for commercial and engineering analyses to be combined to yield "cross-sectional" data on the range load, its costs and rewards, which can safely be applied on community-wide scales if conscientiously and completely prepared.

Not the Decision, but the Delay

AFTER three years of controversy and confusion, the much-mooted question of whether or not the new type of wire technically called "non-metallic sheath cable" shall be approved is on the high road to decision under the code. This material has been commonly known by the trade name of "Romex," after the product first introduced. Last week the electrical committee of the National Fire Protection Association agreed upon rules under which its use will be permitted, once the committee recommendations are approved by the N. F. P. A. and the American Engineering Standards Committee. The rules adopted were substantially the minority rules recommended by W. H. Blood, Jr., a representative of the National Electric Light Association on the electrical committee and a member of the "Article Five" committee, in whose hands the fortunes of this new product have rested for so long. This minority report was much more liberal in its terms than the majority opinion.

The reason why "Romex" has been a storm center in the industry, the subject of endless debate and an unfortunate amount of acrimony and recrimination, is that it had become a test case of the procedure which should be followed in the consideration of new products that apply for approval under the National Electrical Code, particularly where the new material apparently threatens the security of competitive materials long established in the market. Some have fought against approval, feeling that it represented an attack upon the sanctity and stability of the code. Others, realizing that today's innovation often becomes tomorrow's standard practice, have battled for the right of a new product to be tried and proved in service. The opponents have been accused of self-interest. The "Article Five" committee has been charged with desiring to impose overzealous restrictions. The Underwriters' Laboratories have been criticised as favorably partisan. It has been a merry joust.

But, after all, the issue of whether or not this particular product was to be admitted is of secondary importance. It is not the matter of a decision that has worn out the patience of the industry, but the delay, which has kept the situation in tedious turmoil. Electrical men feel that when a new product applies for entry under the code it should receive reasonably prompt action, that it should be tested and a decision for or against be promptly made, so that its producers and the manufacturers and purchasers of competitive materials may know what to do. "Romex" was presumably as safe or as dangerous to use three years ago as it is today, and the same rules now adopted for its governance, it would seem, could have been adopted with equal propriety one or two years back. Surely the function of any committee that has the power of approval should be not to delay but to decide and thus save the waste of time, money and words.

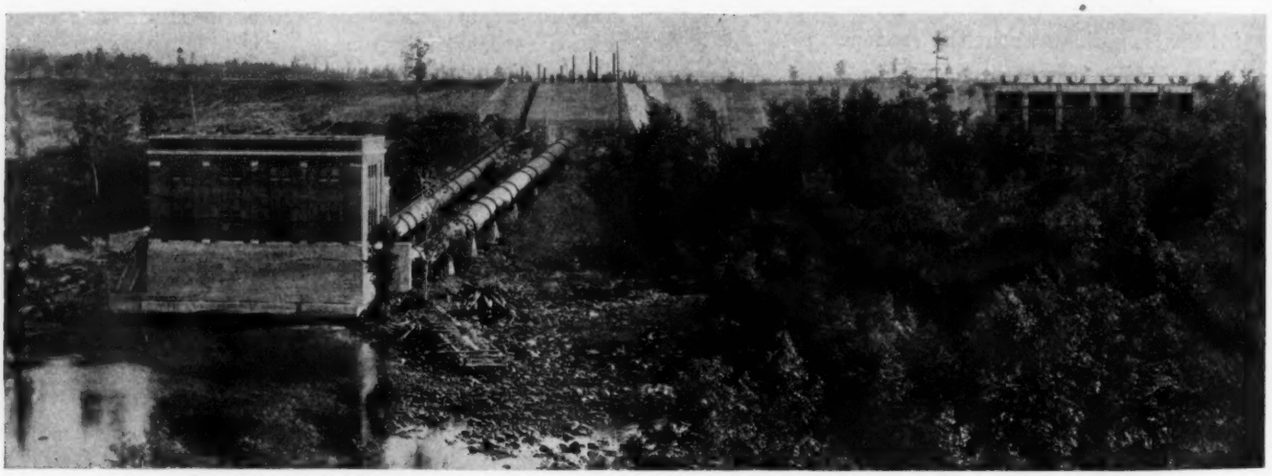


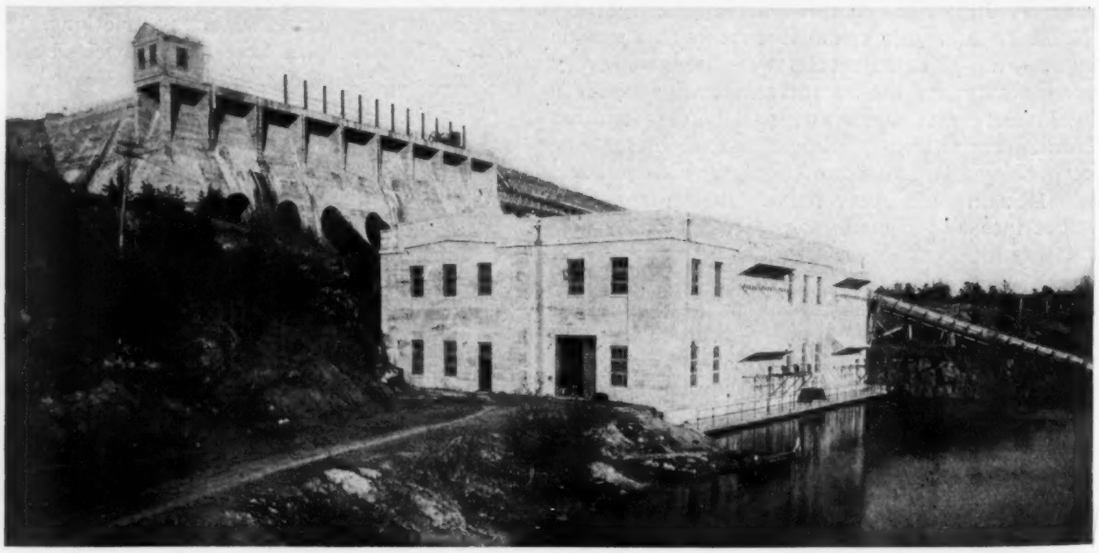
Two Successful Automatic Hydro Stations on Peshtigo River, Wis., Have Warranted Two More

At Top—Supervisory control is maintained from this station at High Falls, which was the first major development on the Peshtigo River. It contains 8,700 kva. in manually operated generators. Sandstone Rapids and Potato Rapids stations are being rapidly equipped with automatic control.

In Center — Johnson Falls station houses two 2,200-kva. generators with automatic switching using "automatic synchronizers."

At Bottom—Caldron Falls (as it appeared just before completion) contains two 4,000-kva. generators using the "self-synchronizing" system of control.





Automatic Plants Added After Experience

Three Plants on Peshtigo River Rated at 17,200 Kva. Total Already Have Automatic Equipment—Unit of 625 Kva. at Another Plant Being so Equipped—Supervisory Control Supplements Automatic Operation

By A. G. CARSON and E. D. LILJA
Manager and Engineer, respectively,
Wisconsin Public Service Corporation, Green Bay, Wis.

AUTOMATIC control of hydro-electric plants, coupled with supervisory control, has been very beneficially applied by the Wisconsin Public Service Corporation on the Peshtigo River, a stream running through northeastern Wisconsin. Three plants on this river are already equipped and one other is being equipped with automatic control because of the satisfactory experience.

The Peshtigo River is particularly adapted to economical hydro-electric development for several reasons. It has an average gradient of more than 11 ft. per mile and contains a large number of rapids and falls. Water storage is facilitated without great expense by the high and rocky river banks. Rock foundation is either exposed or close to the surface, permitting the construction of economical structures. Although the 1,123 square miles of drainage area is, for the greater part, rocky and precipitous, there is sufficient ground storage, coupled with the lakes and swamps feeding the stream, to maintain a fairly satisfactory flow during the seasons of light rainfall. A hydrograph is shown in Fig. 1.

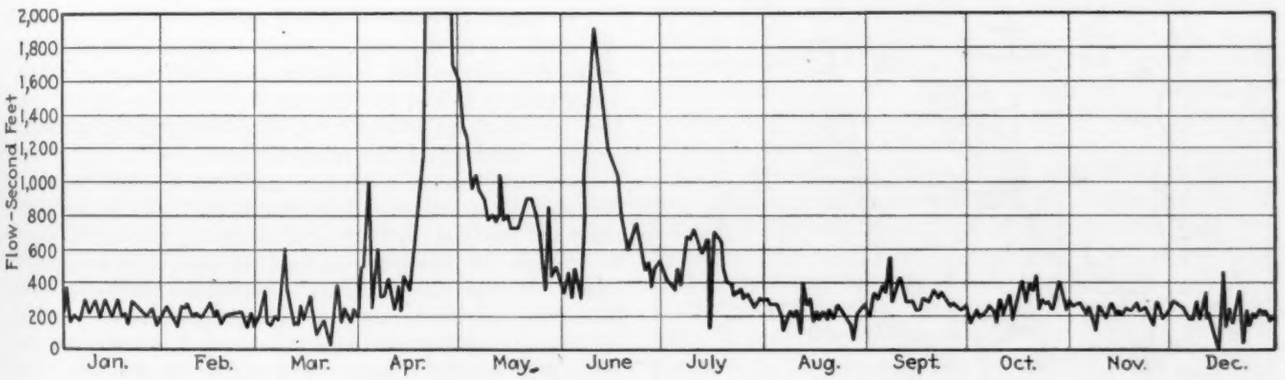


FIG. 1—NORMAL STREAM FLOW OF PESHTIGO RIVER PAST HIGH FALLS (1923)
The average flow since 1909 has been 0.9 cu.ft. per second per square mile of drainage area

Ordinarily, with a stream flow as variable as that indicated, it would hardly be economical to develop the power sites for much in excess of the average flow. However, the Wisconsin Public Service Corporation's ultimate generating system will include sufficient steam-plant capacity to make the cost of steam-generated auxiliary and stand-by service for the hydro plants a small portion of the total steam generation cost. This permits higher development of the stream.

Power developments at Caldron Falls, High Falls, Johnson Falls, Sandstone Rapids, Crivitz, Potato Rapids and Peshtigo (Fig. 2.), on the Peshtigo River, are owned by the corporation. Johnson Falls, Caldron Falls and Sandstone Rapids have automatic operation, and Potato Rapids is being so equipped. Since there are no other developed sites on the river, it is permissible to control the flow and regulate the output of the hydro plants to accommodate the system power demands (Fig. 5), reducing the amount of spilled water to a minimum and increasing the degree of development of each site. A drop in frequency sufficient to start automatic operation will bring 17,200 kva. of machine capacity on the line in a few seconds. Starting High Falls adds 8,750 kva. more to the line.

Two of the dams constructed have resulted in extensive ponds. The one at High Falls, designed for a maximum head of 85 ft., has flooded an area of 1,750 acres and produced a pond of 785,000,000-cu.ft. capacity. The pond produced by the Caldron Falls dam, about eight miles above High Falls, has a storage capacity which is nearly equal to that of High Falls. This storage permits the ironing out of the fluctuating stream flow and the utilization of all except the extreme peak flows.

In order to utilize the natural advantages offered by these hydro-electric station sites, large machine capacity was installed, developing the stream flow to 1.05 and 1.36 cu.ft. per second per square mile of drainage area at High Falls and Caldron Falls, respectively. Johnson Falls and Sandstone Rapids utilize the water released from High Falls, and are therefore developed for the same stream flow. The remainder of the properties on the river were built to serve other interests and have been acquired by the corporation in recent years.

All of the automatic plants have Allis-Chalmers generator units and employ Westinghouse control.

Johnson Falls Plant.—Johnson Falls, the second site on the river to be developed by the corporation (1922) and the first site to be developed for automatic control,

is only three and one-half miles below High Falls. Consequently there is comparatively little storage between the two plants. However, with one machine out of five running at High Falls, Johnson Falls is able to run at full load for eight hours. This rather flexible operation is made possible by the Thunder River, which empties into the Peshtigo between High and Johnson Falls. The development was designed for a maximum head of 42 ft., which raises the headwater to the level of the tailwater at High Falls.

Installed at the plant are two 2,200-kva., 2,300-volt, 150-r.p.m., 60-cycle, vertical-type, water-turbine generators with direct-connected exciters. Each exciter is large enough to serve two machines, and provision is

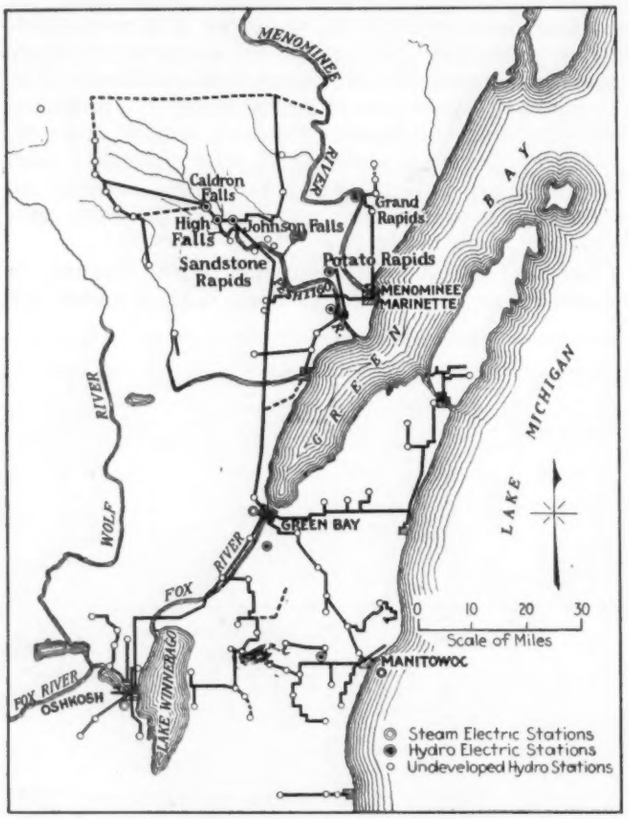


FIG. 2—PESHTIGO RIVER STATIONS OF THE WISCONSIN PUBLIC SERVICE CORPORATION

made for exciting either or both machines from either exciter should this be desirable. The generating and switching equipment is standard. There are no amortisseur windings in the generators, and no external reactors are used. Each waterwheel governor is equipped with a direct-current magnetic oil relay valve that will start the wheel when its solenoid is energized and shut the wheel down when the solenoid is de-energized. The voltage of each machine is controlled by a separate motor-operated high-speed faceplate type of regulator controlling the resistance in the generator field circuit. Direct-current operated magnet valves operate the air brakes.

The operator at High Falls can obtain direct indications of headwater elevation and gate openings of the two wheels. He can also open a sluice gate, start and stop either machine, and control the load on the machines within the limits of the governor settings. In addition, he can close three high-tension circuit breakers feeding out from the substation to three transmission lines. All these operations are carried out by dialing on an automatic telephone at High Falls. (See ELECTRICAL WORLD, Oct. 24, 1925, page 857.) A buzzer on the telephone equipment repeats all dialing operations so that the operator can rectify any misdialing. When an indication of conditions at the automatic plant is desired, dialing will bring a reply in code through the buzzer.

At Johnson Falls there are eight conditions that will automatically sound a shrill warning at High Falls. They are:

1. Failure of the governor oil pressure.
2. Abnormal machine winding temperature.
3. Failure of oil circulation through the thrust bearing.
4. Failure of the oil supply to the guide bearing.
5. Failure of the water supply to the lignum vitæ bearing.
6. Cessation of water circulation through the oil-cooling coils.
7. Overheated bearings.
8. Opening of the circuit breaker on one of the transmission lines.

By dialing for test, the High Falls operator is able to tell which condition caused the warning to sound.

A FEW AUTOMATIC OPERATIONS

The following conditions will cause a machine to shut down and be locked out: Internal winding trouble, oil-pressure failure, hot bearings and overvoltage. Once a machine is locked out it cannot be started again until the cause of its locking out has disappeared and the lockout relay has been reset by hand.

Overload relays open the machine circuit breakers in case of overload. The machines will be brought back on the bus by the synchronizing device if there is voltage on the bus (indicating that the system is live). If the bus is dead, a periodic reclosing relay closes the circuit breaker of one machine almost immediately, energizing the bus. If there is trouble on the line, this circuit breaker will again be opened. The periodic relay will close the breaker a second time after an interval of 24 seconds. If the breaker opens again, it will be reclosed after another 24-second interval. A third opening of the circuit breaker within a definite time interval results in locking out the machine.

Breaking of a governor belt will shut down the machine affected. Abnormal temperatures in any of the substation transformers will shut down one machine. The machine cannot come back on the line until the transformer cools.

Automatic "speed matchers" at Johnson Falls perform the synchronizing operation in exactly the same manner as, but with more precision than, an operator would do it in manual operation. The machine to be placed on the bus is brought up to speed and normal voltage first. When it is in phase with the bus voltage, the machine circuit breaker is closed and the machine takes full load.

The plant starts automatically when the system frequency drops to 57 cycles, indicating excessive load on the stations then on the line. One machine is placed on the line first. If the frequency does not rise above 57 cycles, the second machine comes on. The frequency relays have no time delay.

An attendant living at Johnson Falls keeps the plant and grounds in good condition.

As is usually the case when new equipment and new

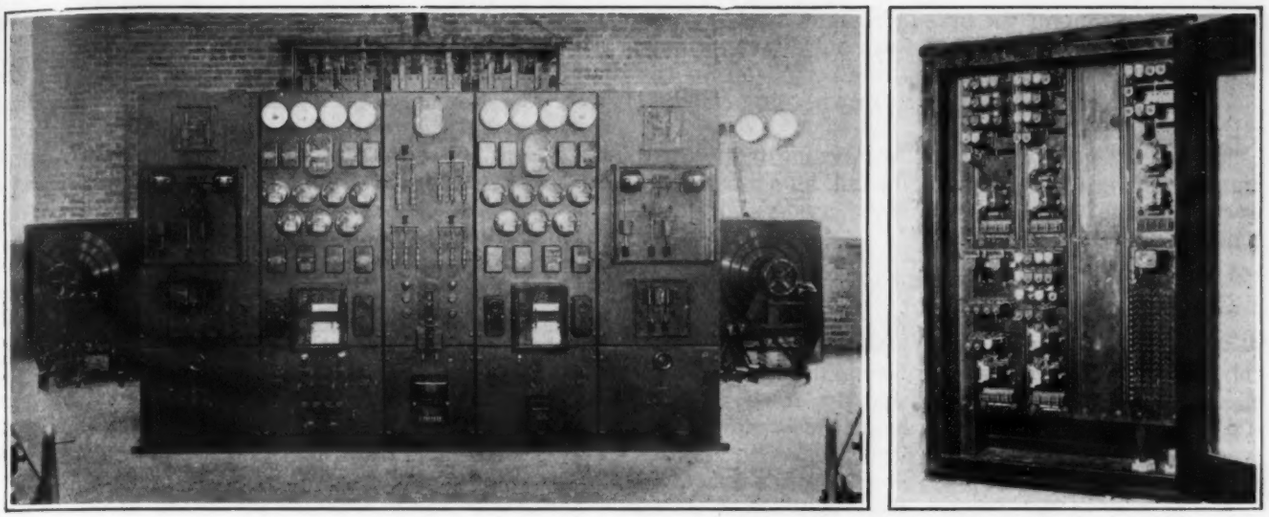


FIG. 3—SOME OF THE AUTOMATIC AND SUPERVISORY CONTROL EQUIPMENT

At left, automatic switchboard at Johnson Falls station. Automatic synchronizing and voltage-regulating equipment on each end panel. Panels 2 and 4 contain the necessary relay and meter equipment for automatic control. The center panel controls various station auxiliaries, lighting circuits, etc. At right, supervisory control cabinet at Johnson Falls.

methods are introduced, there were a number of problems to be solved before the control at Johnson Falls could be considered entirely automatic. It was appreciated that one machine might be on the line carrying full load and also carrying a high wattless current. This would not be known at High Falls until the windings became sufficiently heated to close the thermostatic relay and sound the shrill warning. The desirability of getting the second machine on the line without waiting for supervisory control is evident. To accomplish this an overload relay was placed in one lead of each generator and so set that a current 25 per cent above normal in either machine would start the other machine automatically.

The possibility of foreign material lodging in the gates, preventing their closure and allowing the gates to drift open again, was guarded against by adding teeth to the gate lock ratchet. This will permit the locking of the gates at any point below 0.1 gate opening. Provision was also made for keeping the oil pressure behind the actuating piston until the gate is completely closed.

Originally, plans called for the application of the brakes when the brake solenoid was de-energized by the master relay. This arrangement presented a number of difficulties. It would have been necessary for the brakes to be applied with the machines running under part-gate opening, because the master relay would start closing down the machines and open the brake circuit at the same time. This was taken care of by arranging to have the gate-lock dog apply the brakes when the gates are completely closed.

To avoid the possibility of the generator operating as a synchronous motor with the brakes applied due to failure of the circuit breaker to open, an interlock was placed on the circuit breaker that will not permit the brakes to be applied until the breaker is open.

As an insurance against the failure of the master relay to open the circuit breaker a device was installed that causes the gate-lock dog to open the circuit breaker when the gates are completely closed, if it is not already open.

The possibility of the solenoid circuit opening accidentally and applying the brakes with the machine in operation was avoided by arranging the brakes so that they are applied when the solenoid is energized. Then

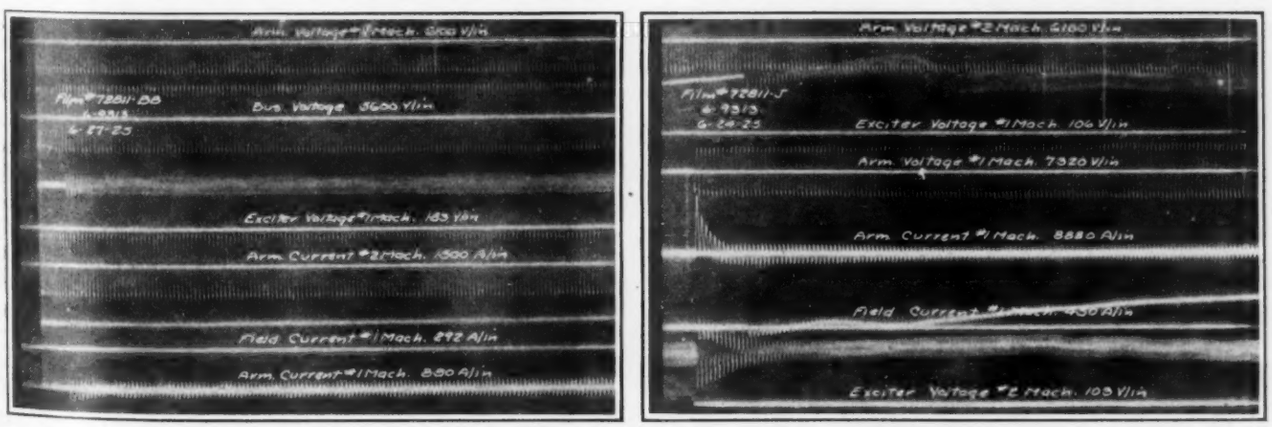

Arm. Voltage #1 Mach. 6100 V/in
Bus Voltage 3600 V/in
Exciter Voltage #1 Mach. 183 V/in
Arm. Current #2 Mach. 1300 A/in
Field Current #1 Mach. 292 A/in
Arm. Current #1 Mach. 880 A/in
Arm. Voltage #2 Mach. 6100 V/in
Exciter Voltage #1 Mach. 106 V/in
Arm. Voltage #1 Mach. 7320 V/in
Arm. Current #1 Mach. 8880 A/in
Exciter Voltage #2 Mach. 103 V/in

FIG. 4—RESULTS OBTAINED WITH AUTOMATIC AND SELF-SYNCHRONIZING PLANTS ON PESHTIGO RIVER

At left, connecting 2,200-kva. generator to system with automatic synchronizer at instant generator circuit breaker was closed. No. 2 unit was carrying full load. No. 1 unit has just been connected to bus, the armature current being shown on lowest line. The current reached 185 amp., or 34 per cent full load; average value reached 130 amp., or 24 per cent full load. At right, synchronizing one of the 4,000-kva. units. The armature current of unit No. 1, or the incoming unit, reached a momentary peak of 8,800 amp., or 8.9 times full-load current. However, it settled quickly to a value below full load. During the pole-slipping process a voltage was induced in the field windings, as evidenced by fluctuations in the exciter voltage of No. 2 unit. A measure of the disturbance is indicated by the voltage drop of unit No. 2, or system voltage, shown on top line.

accidental opening of the brake circuit will only release the brakes. At most, the wheel can only start turning, and if there is sufficient leakage to accomplish this, the machine will run fast enough to provide proper lubrication of the bearing.

To keep the governor pumps from losing their prime and permitting the oil pressure to fall, an arrangement was devised for priming the pumps automatically each time the oil valves open.

EXPERIENCE ENTIRELY SATISFACTORY

Since Johnson Falls plant was placed in operation (July, 1923) the automatic operation has proved not only more economical but also more dependable than manual operation. The plant handles itself through storms better than it would if manually operated. The synchronizing apparatus has never failed to operate perfectly.

The success of the Johnson Falls installation led to further aplication of this form of control. Since the later installations are similar in design to that at Johnson Falls, only their differences will be discussed.

Caldron Falls Plant.—The next plant built (1923) was at Caldron Falls, the largest single concentration of fall (55 ft. in 800) in the river. The dam provides a maximum head of 81 ft.

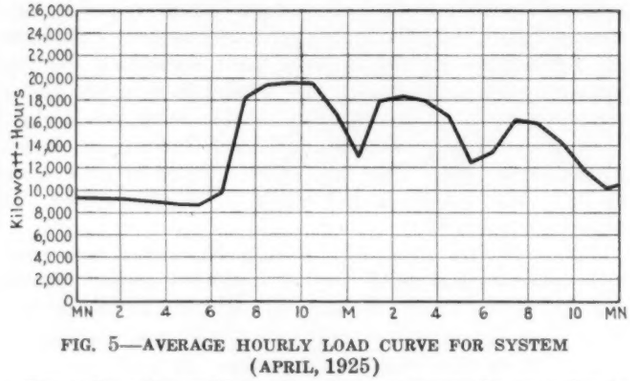


FIG. 5—AVERAGE HOURLY LOAD CURVE FOR SYSTEM (APRIL, 1925)

The daily and monthly load factors are unusually good due to diversity of loads and long-hour use of energy.

Two 4,000-kva., 60-cycle, 2,300-volt, 225-r.p.m., vertical-type generators are installed, equipped with direct-connected exciters. Each unit is driven by a single-runner, 4,650-hp. water turbine. The generators are equipped with amortisseur windings. The units are brought up unexcited to a speed slightly below synchronism. Then they are thrown on the line by the automatic equipment. Immediately following this operation a field is applied to the generators, pulling them into step and making them take load. This method of synchronizing insures that, if the equipment is needed, a machine will be on the line taking load within half a minute, regardless of the frequency variation of the system.

Because of the method of synchronizing, two governor solenoids are used. The first brings the machine up to normal speed at no load. The second, applied after the generator circuit breaker is closed, opens the gates to a value corresponding to the load "dialed on." If the machine comes on automatically, due to low frequency, it will take full load until "dialed back" from High Falls. As is the case at Johnson Falls, a storage battery provides the control current. The battery is charged automatically by a motor-generator set when either machine starts.

The Caldron Falls protective equipment is practically the same as that at Johnson Falls. Supervisory control from High Falls is maintained over two wires also used for telephone communication. The governor flyballs are motor driven. In contrast with the Johnson Falls plant, oil-operated brakes were installed. At first the use of oil proved generally unsatisfactory at this plant. Leakage, developed by chattering of the brakes, caused oil to be thrown out into the flywheel and eventually into the generator windings. This difficulty was eliminated by draining the leakage back to the governor tank. Because of lower first cost and higher efficiency, vibrating regulators were installed.

The machine circuit breakers do not open under full-load current when the machines are "dialed off." Instead they open when the gates are completely closed. This is a desirable feature, in that it keeps the breakers in good operating condition.

Sandstone Rapids Plant.—The plant at Sandstone Rapids was placed in operation Jan. 1, 1926. The natural fall at this site was only 24 ft., occurring in two rapids about half a mile apart. The maximum head made available by the dam is 43 ft. Two 2,400-kva., 60-cycle, 6,900-volt, 150-r.p.m. generators with direct-connected exciters are installed. The generator excitation of each machine is adjusted automatically, as at Johnson Falls. Despite the fact that an automatic "speed matcher" is used, the generators have amortisseur windings. This makes a very flexible installation. As in the other two automatic plants, there are two methods of starting. Air brakes are used, as at Johnson Falls. The protective devices are practically the same as at Caldron Falls.

Potato Rapids Plant.—At Potato Rapids, on the Peshtigo River about five miles north of Peshtigo, a 625-kva., 60-cycle, 2,300-volt, 128.5-r.p.m. vertical generator with direct-connected exciter is being installed in a plant already housing two 550-kva. generators. The new unit is to be automatically controlled by the operation of a float switch and by push-button control on the switchboard. The unit will have practically the same control and protective features as those at Sandstone Rapids.

ECONOMIC CONSIDERATIONS

Before the Johnson Falls installation it was practically impossible to predict exactly what the saving of automatic over manual control would be at that plant. It was appreciated that the reduction in the operating force from three operators and a chief operator to a single attendant would mean a saving of about $4,000 a year in salaries and about $2,400 a year in charges to operators' houses. It was also known that the annual charges on the additional equipment required for automatic control would be less than $6,400. However, the addition of the supervisory control, necessary to proper load dispatching, introduced another problem. It is difficult to charge properly the costs of supervisory control. It is even more difficult to forecast such charges, especially when new methods are concerned.

The actual figures for 1924 show the maintenance cost per kilowatt-hour generated at Johnson Falls to be practically the same as that where manual operation prevails. The operation cost per kilowatt-hour generated is less than half of that at High Falls—a manual plant. This indicates, in a general way, what economies are being effected with automatic control at Johnson Falls.

Economical Wire Size for Lighting Secondaries

A New Circuit Cost Equation Based Upon the Loss in Lighting Revenue Due to Secondary Line Drop—Development and Use of Charts for Ready Application

By H. S. LITCHFIELD
Distribution Engineer, Providence, R. I.

THE most economical size for an electrical conductor is usually assumed as that size for which the annual fixed charges on copper are just balanced by the cost of supplying the I^2r line losses. In applying the Kelvin law to such portions of the distribution system as lighting secondaries certain limitations should be emphasized. Secondary conductors are operated at such a low current density that the I^2r losses are comparatively small. The distribution engineer usually finds that voltage drop, and not cost of losses, is the limiting factor.

This limitation in the use of the usual economical cost formula is due to the fact that it is based entirely upon the cost of the loss in input without regard for the economic effects of reduced consumer voltage. In the development of the new circuit cost equation that follows, the term "unearned revenue" has been introduced. It designates the net income from the additional energy that would be sold at the higher lamp voltage if the secondary line drop were reduced to zero.

The annual cost of a lighting circuit may then be set up algebraically as the sum of the fixed charges on copper, the cost of I^2r line losses, including generating capacity to supply losses, and unearned revenue. These costs are shown graphically in Fig. 1. The total cost is a minimum when $\frac{dY}{dx} = 0$; Y = fixed charges on copper plus the sum of the cost of losses and unearned revenue. The dotted line represents total cost as computed by the Kelvin law. A comparison of these two curves shows at a glance the necessity for including the loss in output due to secondary line drop as a circuit cost. Any saving that might be made by installing smaller copper is counterbalanced by a decrease in kilowatt-hours metered at the lower voltage, and consequently by a reduction in revenue derived from burning the same lamps over equal periods of time. This decrease in actual revenue is indicated by the rise in the curve for unearned revenue.

Further inspection of the cost curves shows that, at the economical point, the cost of I^2r line losses is relatively small. If these losses are neglected, the error in computing economical secondary line drop is well within the limits of accuracy necessary for the selection of the nearest commercial wire size. Consequently the equation has been simplified and an approximate working formula developed. The circuit cost is assumed a minimum for that wire size and voltage drop at which the fixed charges on copper are equal to the unearned revenue.

Assume a load of tungsten lamps with a kilowatt-hour meter, supplied by a 115-volt, single-phase, secondary line from a separate transformer on a branch primary line of a regulated lighting feeder. Unity power factor is assumed. Current and voltages at full load are illustrated schematically in the circuit diagrams of Fig. 2.

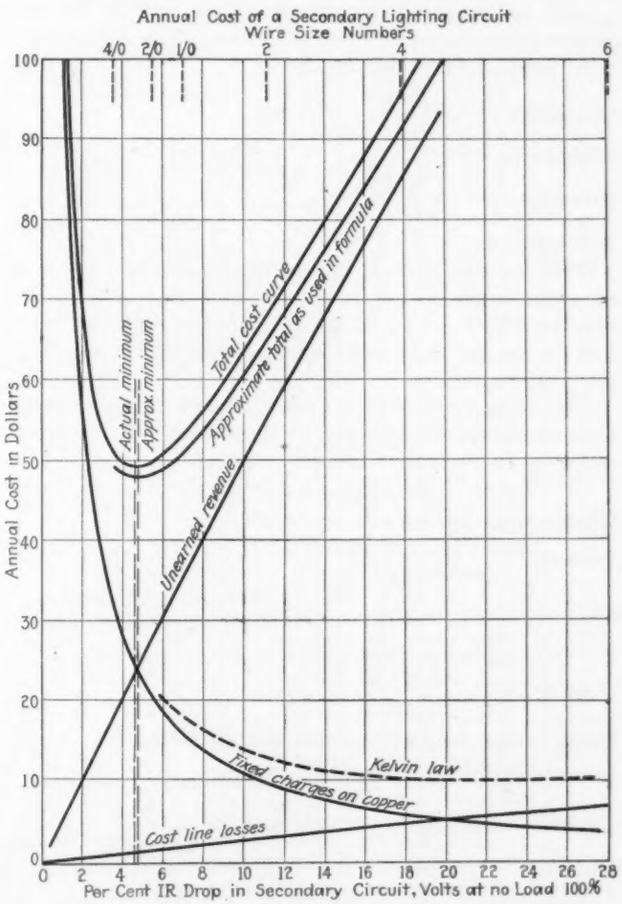


FIG. 1—TOTAL ANNUAL COSTS OF A LIGHTING CIRCUIT INCLUDING UNEARNED REVENUE ITEM

Two-wire, 115-volt 40-amp. maximum.
Length 1,000 ft., primary drop 2 per cent.
Power factor 100 per cent, loss factor 10 per cent.
TBWP copper, 16 cents.
Net revenue, 8 cents per kilowatt-hour.
Fuel cost of energy, 0.6 cents.
Generating capacity $12 per kilowatt per year.
Tungsten lamp load.
Total annual cost is a minimum when $\frac{dY}{dx} = 0$.

Y = fixed charges on copper plus unearned revenue plus cost of line losses.

In the approximate formula for economical wire size and voltage drop the cost is assumed a minimum when fixed charges on copper = unearned revenue.

The cost as computed by the Kelvin law is shown. It is the sum of the fixed charges on copper plus cost of line losses. Comparison of this curve with those above illustrates the practical necessity for including revenue unearned because of excessive voltage drop as a circuit cost.

The following current and voltage symbols are used:

E = No load lamp volts. Equivalent secondary voltage maintained at center of regulation of primary feeder.

Ez = Volts at transformer terminals at full load, z being the decimal ratio of full load transformer voltage to volts at no load.

Ex = Full load lamp volts at end of secondary line, x being the decimal ratio of full load to no load lamp voltage.

I = Amperes at full load if volts E were constantly maintained at lamps.

I_t = Amperes at full load if volts Ez were constantly maintained at lamps.

I_m = Amperes at full load when volts Ex are constantly maintained at lamps.

From the empirical law for tungsten lamps the hot resistance characteristics of tungsten filament are such that the current varies approximately as the 0.58 power of the applied voltage. This applies to small fluctuations above and below rating. The 0.6 power is used here as an approximation.

Therefore $\frac{I_m}{I} = \left[\frac{Ex}{E}\right]^{0.6} = x^{0.6}$

Whence $I_m = Ix^{0.6}$.

Likewise $\frac{I_t}{I} = \left[\frac{Ez}{E}\right]^{0.6} = z^{0.6}$

Whence $I_t = Iz^{0.6}$.

That is, the current I_m drawn by lamps at the end of a line with any given resistance and voltage drop may be expressed in terms of I, the current that would flow to the lamps if supplied by a perfect circuit at 100 per cent regulation.

The volts at the transformer secondary terminals at maximum load are Ez and at the meter, Ex. The voltage drop in secondary therefore equals

$$Ez - Ex = E(z - x)$$

The secondary drop also $= rI_m$, where

$$r = \frac{\left\{\begin{matrix}\text{Resistivity of copper} \\ \text{per circ.mil ft.}\end{matrix}\right\} \times \left\{\begin{matrix}\text{length} \\ \text{in feet}\end{matrix}\right\} \times \left\{\begin{matrix}\text{Number of conductors} \\ \text{carrying full current}\end{matrix}\right\}}{\text{Cross-sectional area in circular mils}}$$

Then $rI_m = \frac{10.6\,LN'I_m}{A} = E(z - x)$.

Substituting for I_m the value derived above

$$\frac{10.6\,LN'}{A} I_m = \frac{10.6\,LN'}{A} \times Ix^{0.6} = E(z - x).$$

Area of conductor in circular mils $= A =$

$$\frac{10.6\,LN'I}{E} \times \frac{x^{0.6}}{z - x}$$

The fixed charge on copper may be expressed as the product of the following factors: g, annual rate of interest and depreciation; N, number of conductors with respect to relative size; L, length in feet; w/1,000, weight of copper per circular mil ft.; C_{wp}, cost of actual copper in dollars per pound, and A, area of conductor in circular mils.

$$\text{Fixed charges on copper} = \frac{gNLwC_{wp}A}{1{,}000}$$

Substituting for A the expression derived above,

$$\text{Fixed charges} = \frac{gNLwC_{wp}}{1{,}000} \times \frac{10.6\,N'LI}{E} \times \frac{x^{0.6}}{z - x} = \frac{10.6NN'wgC_{wp}L^2I}{1{,}000E} \times \frac{x^{0.6}}{z - x}$$

The watts unsold on account of secondary line drop at full load equal the watts that would be sold if the transformer voltage Ez were maintained at the lamps, minus the watts actually metered at the end of the secondary line at voltage Ex. This is illustrated in the circuit diagram as the difference between the watts metered in Case II with secondary voltage drop negligible, and the watts consumed in Case I with any arbitrary secondary line resistance. (Fig. 2.)

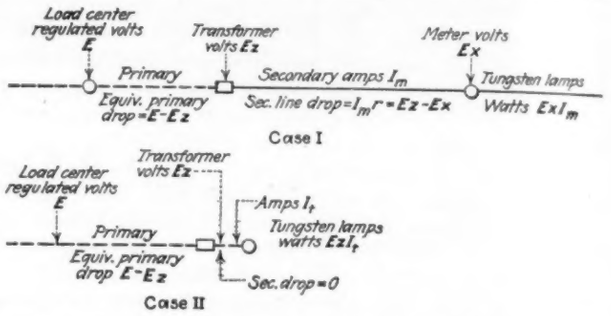


FIG. 2 — FULL LOAD CURRENT-VOLTAGE CHARACTERISTICS ON ASSUMED CIRCUITS. CASE I—SECONDARY WITH ANY RESISTANCE. CASE II—SECONDARY LINE DROP NEGLIGIBLE

Watts unsold $= EzI_t - ExI_m$

Then since $I_m = Ix^{0.6}$ and $I_t = Iz^{0.6}$ as above

Watts unsold $= Ez(Iz^{0.6}) - Ex(Ix^{0.6})$

$= EI(z^{1.6} - x^{1.6})$

If constant full load is maintained fH hours per year, where f = load factor and H = 8,760 hours per year

$$\text{Kilowatt-hours unsold} = \frac{fHEI}{1{,}000}(z^{1.6} - x^{1.6})$$

If the net revenue is V dollars per kilowatt-hour,

$$\text{Unearned revenue} = \frac{VfHEI}{1{,}000}(z^{1.6} - x^{1.6})$$

for constant load such as multiple bridge lighting or non-flashing sign.

In order to determine the variation in unearned revenue with fluctuating load, a separate equation was developed and plotted as shown in Fig. 3. It will be seen from the position of the points plotted that the watts unsold at each fractional load vary very nearly as the square of the line current. This variation as the square of the current at once suggests the use of the loss factor,

$$F = \frac{\text{Sum of squares of hourly ordinates}}{24 \times (\text{Ordinate of annual peak load})^2}$$

computed from the typical daily load curve.

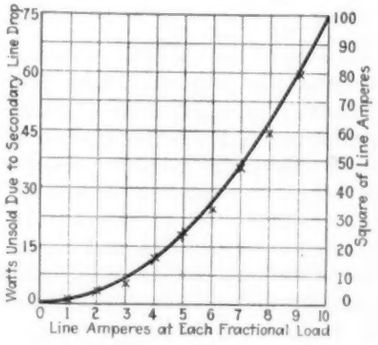


FIG. 3 — VARIATION IN UNEARNED REVENUE WITH FLUCTUATING LOAD

Watts unsold at any fractional load = $EpI_m[(1 - p + pz_m)^{1.6} - (1 - p + px_m)^{1.6}](1 - p + px_m)^{0.6}$ where p = per cent of full load current ÷ 100. Curve drawn for square of line current and points plotted for watts unsold at each fractional load.

E = 115 volts.
I_m = 10 amp.
z_m = 0.98.
x_m = 0.94.

The unearned revenue for fluctuating load may then be expressed as the loss in income at full load times FH hours rather than fH hours, as derived for constant load. The expression FH represents the equivalent

hours per year that constant full load must be maintained in order to produce the same kilowatt-hours in I^2r line losses and the same value in unearned revenue as obtained with the actual fluctuating load.

$$\text{Unearned revenue} = \frac{VFHEI}{1{,}000}(z^{1.6} - x^{1.6})$$

for a tungsten lamp load curve of any shape.

Economical Ratio

The cost of the circuit is assumed a minimum when fixed charges on copper equals unearned revenue, or when

$$\frac{10.6NN'wgC_{wp}IL^2}{1{,}000E} \times \frac{x^{0.6}}{z-x} = \frac{VFHEI}{1{,}000}(z^{1.6} - x^{1.6})$$

Letting a and θ stand for the coefficients:

$$a\frac{x^{0.6}}{z-x} = \theta(z^{1.6} - x^{1.6})$$

$$ax^{0.6} = \theta(z^{1.6} - x^{1.6})(z - x)$$

$$\frac{a}{\theta} = z^{2.6}x^{-0.6} - z^{1.6}x^{0.4} - zx + x^2$$

which is designated as the economical ratio. The expression to the right of the equals sign is plotted on the economical wire size diagram for $z = 0.98$; that is, 2 per cent primary drop. This is the curve for economical per cent secondary voltage drop. (Fig. 4.) The ratio of the coefficients $\frac{a}{\theta}$ is computed from the circuit constants and costs for each given problem.

The evaluation of $\frac{a}{\theta}$ is simplified by setting $I = 1$ amp.; $H = 8{,}760$ hours per year, and $L = 100P$, where P is the equivalent number of 100-ft. pole sections from transformer to meter. $w = 0.00303$ lb. per 1,000 circ.mil ft. and 10.6 is taken as the resistivity of copper per circular mil foot.

$$\frac{a}{\theta} = \frac{NN'10.6 \times 0.00303gC_{wp}100^2P^2}{1{,}000E} \div \frac{8{,}760VFE}{1{,}000}$$

$$\frac{a}{\theta} = 0.037.\frac{NN'gC_{wp}P^2}{E^2VF}$$

For a distance of 1,000 ft. from transformer to meter $P^2 = 100$ and $\frac{a}{\theta} = 3.7\,\frac{NN'gC_{wp}}{E^2VF}$

Method of Computation

In order to compute the economical wire size and voltage drop to supply a given load, determine the following circuit constants and costs:

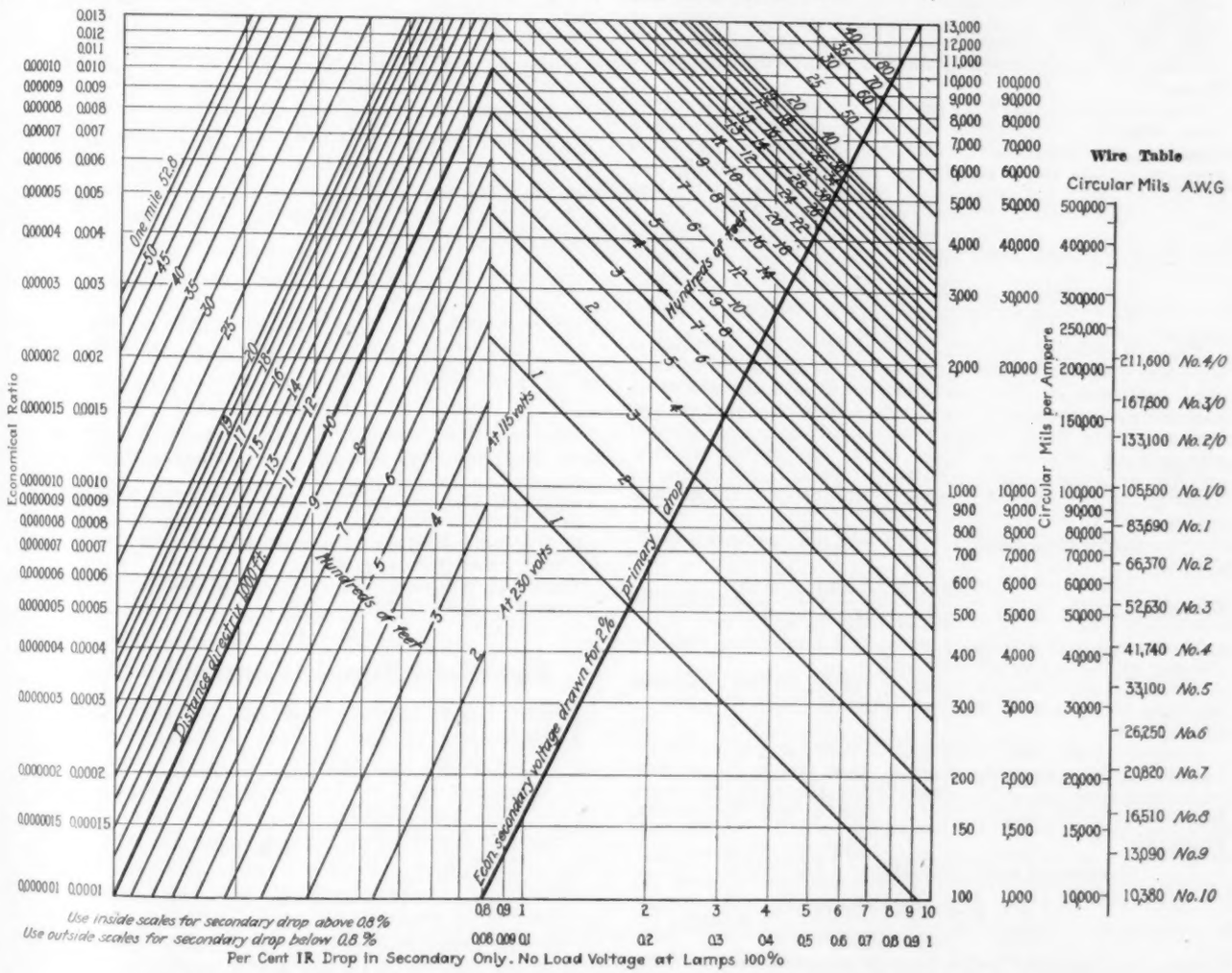


FIG. 4—DETERMINATION OF ECONOMICAL WIRE SIZE AND VOLTAGE DROP FOR LIGHTING SECONDARIES

Compute economical ratio for 1,000 ft. $= 3.7\,\frac{NN'gC_{wp}}{E^2VF}$.

Project horizontally from left-hand scale to directrix, then vertically to line for required distance, then horizontally to economical voltage curve. Read per cent Ir drop in secondary circuit on bottom scale. Project vertically to line for same volts and distance as above. Read circular mils per ampere (at peak load) on right-hand scale. For distance or voltage other than those drawn compute economical ratio $= 0.037\,\frac{NN'gC_{wp}P^2}{E^2VF}$. Project directly from left-hand scale to voltage curve. Compute circular mils per ampere $= \frac{2{,}120P}{E \times \text{Econ. \% Sec. Drop} \div 100}$ for same value of E and P as above. Multiply c.m. per ampere by amperes at annual peak. Check nearest wire size for Ir and IX drop.

N = Number of conductors with respect to relative size. For three-wire, single-phase, neutral ½ size, set $N = 2.5$. For three-wire, single-phase, neutral 2 sizes A.W.G. smaller, $N = 2.63$.

N' = Number of conductors carrying full current only, $N' = 2$ for both two- and three-wire systems.

C_{wp} = Cost of conductor in dollars per pound of actual copper. As an approximation for TBWP, multiply charging out price by 1.2 for sizes 1/0 to 4/0, and by 1.3 for No. 2 to No. 6.

g = Annual fixed charge rate on insulated wire; includes interest, depreciation and taxes.

V = Net lighting revenue per kilowatt-hour. Consumer's rate less cost of manufacture and distribution.

F = Loss factor, derived from typical daily load curve,

$$F = \frac{\textit{Sum of squares of hourly ordinates}}{24 \times (\textit{Ordinate of annual peak load})^2}$$

E = Volts at lamps at no load. Per cent line drop is based upon no load volts = 100 per cent, and should not be confused with "regulation" based upon per cent rise above full load voltage.

I = Current at peak load.

P = Equivalent number of 100-ft. pole sections from transformer to meter.

Primary voltage drop at full load, including line and transformer, should be determined and added to the secondary line drop as finally computed from the chart. The voltage drop on the consumer's premises between meter and lamp is included with lamp voltage for the purpose of computing secondary wire size. The calculation of the correct sizes for interior wiring constitutes a separate problem.

Example 1:

Compute economical wire size and voltage drop for a two-wire, 115-volt, single-phase secondary circuit supplying a tungsten lamp load 700 ft. from the transformer. Maximum amperes = 30. Copper $0.16 per pound, with fixed charges at 15 per cent; net revenue per kilowatt-hour, $0.07; loss factor of 10 per cent. Primary drop assumed 2 per cent.

$$\text{Economical ratio for 1,000 ft.} = 3.7\,\frac{NN'gC_{wp}}{E^2VF} = 3.7\,\frac{2 \times 2 \times 0.15\,(0.16 \times 1.25)}{115^2 \times 0.07 \times 0.10} = 0.0048$$

From 0.0048 on the left-hand scale of the economical wire size diagram project horizontally to distance directrix, then vertically to line for 700 ft., than horizontally to economical secondary voltage curve. Read economical per cent secondary drop, 3.8 per cent, on bottom scale. Project vertically to 115-volt curve for 700 ft. and read 3,400 circ. mils per ampere on right-hand scale. Total circular mils = 3,400 × 30 = 102,000 circ.mils. Nearest standard wire size is 1/0.

If served by three-wire, 115/230-volt, single-phase secondaries:

$$\text{Economical ratio} = 3.7\,\frac{2.63 \times 2 \times 0.15 \times 0.20}{230^2 \times 0.07 \times 0.10} = 0.00158$$

The economical secondary drop is 2.2 per cent and the circular mils per ampere = 2,900.

Total circular mils = 2,900 × 15 = 43,500. Nearest wire size is No. 4 with No. 6 as neutral.

Example 2:

Compute economical wire size for house service drops. Length 75 ft., two-wire, 115-volt, loss factor 5 per cent, maximum amperes = 6, other values the same as above. Since no line is drawn for $P = 0.75$, use the general formula:

$$\text{Economical ratio} = 0.037\,\frac{NN'gC_{wp}P^2}{E^2VF} = 0.037\,\frac{2 \times 2 \times 0.15 \times 0.20 \times 0.75^2}{115^2 \times 0.07 \times 0.05} = 0.000054$$

Using the outside scales on the diagram project from economical ratio 0.000054 on left-hand scale directly to economical voltage curve. Economical secondary drop = 0.58 per cent. Economical circular mils per ampere is computed from the formula

$$\frac{2{,}120P}{E \times \textit{Econ. \% sec.drop} \div 100} = \frac{2{,}120 \times 0.75}{115 \times 0.0058} = 2{,}380.$$

Total circular mils = 2,380 × 6 = 14,280. The nearest size A.W.G. is No. 9, while the nearest size used in distribution work is No. 8.

The preceding equations were developed for a simple case: Concentrated load of tungsten lamps at any given distance from a distributing transformer. The application of these principles may be extended to practical distribution problems in accordance with the following general conclusions:

1. The theoretically economical wire sizes for different distances do not vary enough to change the nearest standard wire size for a given load for secondary runs of the usual length—100 ft. to 1,000 or 1,500 ft.

2. The economical voltage drop is nearly proportional to the distance—as would be expected if the wire size remained unchanged.

3. For a given voltage and type of circuit supplying lighting load, the economical current density (circular mils per ampere) is determined by the cost and fixed charge rate on copper and by the net revenue per kilowatt-hour and shape of load curve.

4. The economical current density for concentrated lighting load may be applied to secondary runs supplying distributed load when due allowance is made for diversity and for voltage drop at varying distances from the transformer. Approximate methods for calculating voltage drop from the sum of the products of the number of services at each pole times the number of spans back to the transformer may be used.

5. If the current-voltage characteristics of a load other than tungsten lamps can be expressed as an exponent, k, of the variation in E corresponding to changes in I, the value of k may be substituted for the exponent 0.6 used for tungsten lamps and the curve for economical ratio

$$\frac{a}{\theta} = \frac{z^{2+k}}{x^k} - z^{1+k}\,x^{1-k} - zx + x^2$$

evaluated and laid off on the diagram. This voltage curve may then be used in the same manner as the curve for tungsten lamps.

REFERENCES

Standard Handbook for Electrical Engineers, fourth edition: Tungsten lamp characteristics, sec. 14, p. 22, 23; Kelvin law, sec. 13, Fig. 14.

Reyneau and Seelye, "Economics of Electrical Distribution": Loss factor as equivalent hours, pp. 39 to 47; voltage drop on secondary runs supplying distributed load, pp. 67 to 69; Kelvin law, p. 48.

Gear and Williams, "Electric Central Station Distribution Systems": Loss factor, p. 345.

Electricity Supply Control by Radio

THE Italian government has recently granted a concession to the Società Italiana Ernesto De Angeli of Milan to establish six wireless transmitting and receiving stations in connection with the electric power station at Ardesio (Bergamo) and at the transformer and distribution sectionalizing stations at Ponte Nossa (Bergamo), Bonate Sopra (Bergamo), Castellazzo (Milan), Legnano and Milan. The purpose of the stations is to transmit by radio operation instructions to the engineers in charge at the various stations. The concession, which is to run for a period of ten years, authorizes a wave length of 1,000 m. for the Bonate Supra and Castellazzo installations and 1750 m. for the others. Messages are only to be transmitted between the hours of 7.30 and 9.30 a.m. and between 4 and 6 p.m., although in cases of emergency they may be transmitted at any other time.

Efficiency in Coal Utilization

Economic and Social Pressure Forcing Large-Scale Power Developments—Great Strides Made in Thermal Efficiency—Distillation of Coal and Reduction in Capital Investments Major Objectives

An Interview with
GEORGE E. LEARNARD
President International Combustion Engineering Corporation

G. E. LEARNARD

"THE efficient and economical use of coal has long been both my business and a hobby, and I have studied this subject very carefully; and, although great progress has been made, I believe there remain many opportunities for developments that will have great influence on the art. Economic and social pressure is being brought to bear in every country to force the development of an abundant and economical power supply. In this country the leaders of the light and power industry have gone far toward completing their announced plans for building co-ordinated and widely extended power systems to give the best and most economical service to the nation. They have gone far to prove that the permanent success and social well-being of a country depend upon an abundant power supply. In Europe, however, much remains to be done before progress is made equal to that made in this country. The greatest asset to Great Britain, to France, to Germany and to other European countries would be a nation-wide electrical power system supplied by large and economical stations. The fact is so evident that the political leaders of these nations are vigorously engaged in attempts to bring about power developments on a large scale. They are bringing to bear educational aids, legislation and financial co-operation in order to obtain the results visioned and desired. They are enrolling in the cause the best financial and technical talent available for making sound plans and for building their power structure."

These expressions on a most important topic were made to a representative of the ELECTRICAL WORLD by George E. Learnard, president of the International Combustion Engineering Corporation. They sum up the thoughts of a business executive who has studied power production and fuel utilization with an international perspective and a man who has contributed largely to the practical developments of the art.

Anyone talking with Mr. Learnard gains the impression that he is a man who believes that thoughts and practices which come "with a professor's mortgage upon them" will never bring about progress. He is a man who speaks with force and enthusiasm and radiates courage and optimism. His associates assert that his success has been based on good judgment and broad vision backed by vigorous and well-directed audacity. Once convinced of the merit of a plan, he drives it through to completion with great energy.

"In my opinion," continued Mr. Learnard, "the economical production and use of power requires the work of men possessing good judgment and an abundance of knowledge. It involves public welfare, the conservation of natural resources, financial and technical problems and the application of sound business principles. Any man or group of men dealing with any aspect of the business must of necessity work with a background of knowledge of the whole power situation if success is to be obtained.

"Those who have developed the art of burning fuel under boilers for producing steam have done a fine job. They have about reached the maximum of thermal efficiency and have built larger and larger units successfully. In our opinion further progress can be made chiefly by introducing low-temperature distillation of fuel and through designs of stations that will reduce the capital investment. The major task is to reduce the total cost of a kilowatt-hour, and these two goals offer great possibilities in this direction.

REVIEW OF DEVELOPMENTS

"It is very interesting to look back over the steps in the progress of the art with which we have been closely associated. Years ago, when we introduced forced draft under chain grate stokers in commercial installations in the Middle West and in Pennsylvania, we sensed the possibilities for burning pulverized fuel and even the use of air heaters, and, after spending large sums in experimental work, we at last introduced pulverized fuel commercially. The use of this fuel in existing types of boilers led us to the adoption of air heaters, water screens and finally to the design of furnaces and boilers to get units better adapted for burning pulverized fuel at the efficiencies we desired.

"Our objects during these years were to obtain higher

thermal efficiencies, a reduction in the cost of plants and greater simplicity in their operation. In large measure, past developments, together with the recent commercial introduction of the 'steam generator,' lead us to think that our goals have been reached. The design of the new device is based upon old and tried principles; it is simple and efficient and particularly well adapted to the burning of pulverized fuel. We believe its use will bring about a very appreciable reduction in fixed charges, which, in modern plants, amount to about one-half the total cost of power, and thus will be very effective in decreasing the cost of a kilowatt-hour at the switchboard. From the data and experiences obtained with an existing installation, we feel sure the 'steam generator' will reduce the building space required per unit of capacity in a power station. In addition it can be sold at a cost that is small per pound of steam generated and is simple, safe and efficient. In a short time we shall have available detailed test data on a commercial installation that has been operating several months in England, so that power men can study actual performance and installation figures. In my own mind and in the minds of our engineers who have observed the plant in operation for several months there is perfect confidence in the unit. We also believe it is possible to develop the steam generator for higher pressure should that be desirable, and there seem to be no difficulties in making units capable of producing 600,000 to 1,000,000 lb. of steam per hour."

DISTILLATION OF COAL URGED

Knowing that Mr. Learnard was greatly interested in the low-temperature distillation of coal, the interviewer asked whether this development was ready for widespread commercial application.

"Low-temperature distillation of fuel is the next big step to take for obtaining a reduction in the cost of a kilowatt-hour," replied Mr. Learnard. "We are ready to introduce it as an economical part of power production. A commercial plant is being installed in Milwaukee, and we feel assured of its success.

"Professor Sweet has well stated that 'mightier than an army is an idea whose time has come,' and I believe the time has come for low-temperature distillation. We believe our process has mastered this problem and can be used profitably. It distills coal in pulverized form at the proper temperature, in large quantities and with a minimum of complexity and capital investment. We think the tar, gasoline and solvents can be produced and marketed profitably and the processed fuel be then used for generating steam. Unsaturated hydrocarbons, limited markets and other bugbears have no terrors for us, because we have studied carefully these aspects of the business.

"In England especially there is a great opportunity for the institution of coal distillation. Legislation will shortly be passed by the government forcing the development of a national power supply from a series of large and economical stations. Since large water supplies are infrequently found at the mines, I believe the government will co-operate in the development of a plan to distill coal at the mine mouths. The motor spirits, tar and oils will be removed and used in industry and the residual fuel sent to power plants and coal users in a pulverized form which can be stored and transported. England now imports motor spirits to the value of 60 million pounds sterling, and our studies lead us to believe that an equivalent amount can be obtained by the distillation of the 'fines' alone, which now have no market and remain unused at the mines. I know that distillation of coal is a vital question in England and interests the government greatly, and I believe the time is here for using distillation both in England and in other countries."

A CONSERVATIVE PROPHECY

In conclusion, Mr. Learnard was asked for his opinion on the major trends of power development. He replied: "Any prophecy in an art that changes so rapidly as power production should be very conservative, but we believe the near future will see two moves that will mean not only cheaper power but also the conservation of national resources. The first of these will be the distillation of fuel, as I stated previously, and the second will be the reduction in cost of power stations. A few years will see a demand for such large quantities of power that each power-producing unit will equal a present-day station in capacity. In my opinion the burning of the fuel, the generation of the steam and the use of steam in a prime mover will involve the design of a single large fuel-burning, steam-generating and steam-utilization unit assembly with a consequent reduction in building space and cost, a great simplification in station layout and at least a slight increase in the efficiency of operation. The details of such a unit are still vague in my mind, but developments in the art indicate a trend toward the elimination of the present separation in the location of boilers and turbines with their costly and complicated accessories and buildings. I believe firmly that the future will see very great progress in power generation in directions that will make for great economies in the use of fuel and material reductions in the cost of power.

"Too much is at stake and too many unmeasured opportunities exist for any nation or any group of men to cease pioneering and building toward better conditions in the art."

Canada's Hydro-Electric Investment Is Estimated at $800,000,000

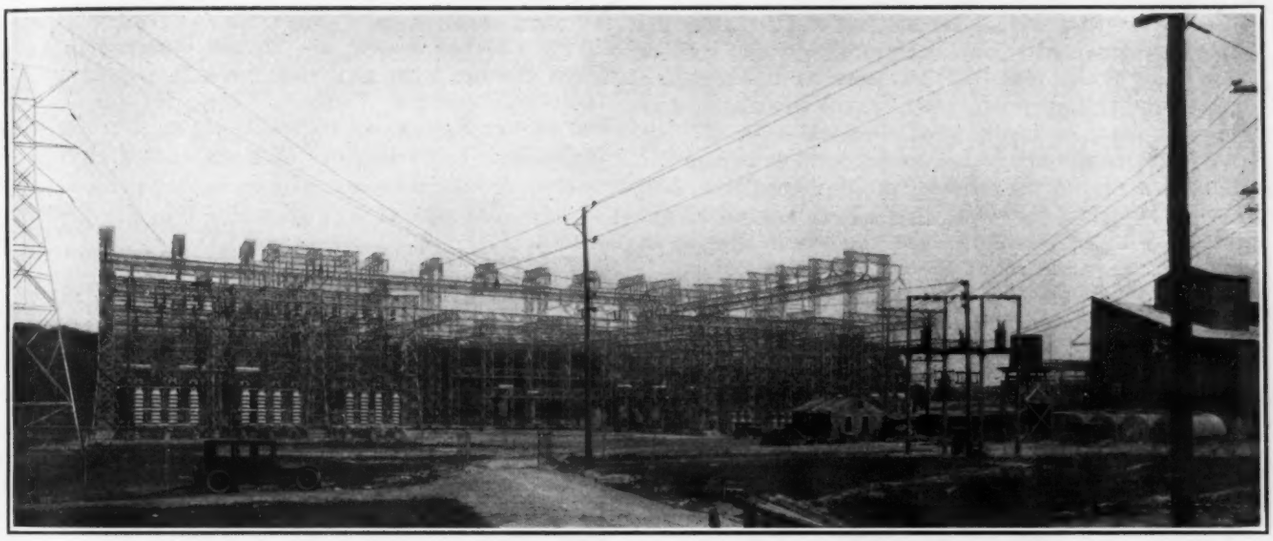
AN INTERESTING summary of water-power development in Canada was made in a recent letter issued by Johnson & Ward, members of the Montreal Stock Exchange. They allude to the agreement of authorities that by far the greatest development is still to come. In 1900, as the result of the work of a single decade, the total installation of hydro-electric energy was 150,000 hp.; by 1910 this had increased to 965,000 hp., or more than six times as much, while by the early part of 1925 the total installation had reached 3,569,275 hp. It is now estimated that, at the end of 1925, the total exceeds 4,100,000 hp.

The latter figure represents over four times the total of 1910 and over twenty-five times the total of 1900. It should be noted also that whereas in the ten years between 1900 and 1910 the increase was 815,000 hp., in the fifteen years between 1910 and 1925 the net increase was over 3,000,000 hp. The total investment by the middle of 1925 was estimated by the Dominion Water Power Branch at around $770,000,000, which has been increased to nearly $800,000,000 at the end of 1925. It is generally agreed that well before 1935 fully $1,000,000,000 will have been invested and be represented by the assets of the hydro-electric industry of Canada.

Toronto Plant Tied In by 132-Kv. Line

Forty-Mile Line Connects Station with Boardman Substation at Youngstown—Insulator Strings Equipped with Rings and Horns—Substation Designed for Ultimate Capacity of 500,000 Kva.

By J. H. WELLS
Electrical Engineer Stevens & Wood, Inc.



BOARDMAN SUBSTATION IS DESIGNED FOR AN ULTIMATE CAPACITY OF 500,000 KVA.

IN CONNECTION with the construction of the Toronto power station for the Ohio River Edison Company at Toronto, Ohio, the problem of transporting this energy to the point of utilization in the vicinity of Youngstown, Ohio, is equally important with the development of the power station.

Toronto is approximately 40 miles south of the Youngstown area. In order to provide for the utilization of the power generated at Toronto a double-circuit 132,000-volt steel tower line was constructed from the Toronto plant to the Boardman substation, just south of Youngstown. The transmission line as constructed consists of double-circuit towers on which are strung two circuits, each of 300,000-cm. copper cable. The average tower spans are approximately 12 ft. with a minimum of approximately 900 and a maximum of 2,500 ft. Throughout the line there are only three strain points, the two terminal towers and one intermediate tower, which was necessitated by uplift under certain severe conditions. Each circuit has a normal rating of 75,000 kva., but will carry 125,000 kva. with reasonable commercial regulation under the conditions of operation. One line is insulated with ten units of 11,000-lb. O.B. cemented cap type unit, and the other line is insulated with nine units of the new Locke Hewlett type. All of the insulator strings are equipped with rings and horns, the purpose of the rings being primarily that of a glorified horn for flashover purposes, although some grading is obtained. Horns are provided at the top of the string with a wide spread and this combination offers a relief from the failure of Hewlett strings through the burning of hardware and prevents damage to either type of insulators where the power arc may follow through high frequency or impact flashovers incident to lightning and other external causes. The latter have been very materially reduced by the installation of a ground wire.

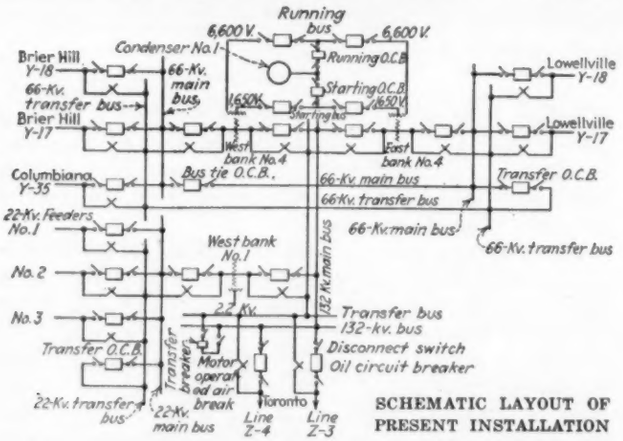
There is one ground wire provided for the double-circuit towers, and experience obtained from the operation of the line before the ground wire was installed and operations after the construction was entirely completed with the ground wire in place indicate that the auxiliary equipment provided for the transmission line in the form of a ground wire, rings and horns has protected the circuits against interruptions that otherwise would have occurred. In stringing the ground wire it was decided to use copper-clad steel carried in suspension hangers lined with soft copper. The suspension clamps are suspended from the peak of the towers with two intermediate links so as to give flexibility equal to that of the conductors and relieve the ground wire of any mechanical handicaps due to method of attachment.

The ultimate development of Toronto plant to 350,000 kva. contemplates the use of a second double-circuit steel tower line. The line capacities are based on having three lines capable of carrying the 350,000 kva., although normally the four lines will take this load. The regulation of the line is controlled, first, by the use of line drop compensators at Toronto, which vary the generator voltage from 10,500 to 12,500 inversely as the load, and, second, by a 15,000-kva. condenser at Boardman connected to maintain automatically 6,600 volts on the tertiary of the transformer tying the existing 66-kv. transmission system with the new 132-kv. lines.

The transmission line feed is through a step-up station at the Toronto power station, where transformers are connected directly in the generator leads stepping up from 11,000 volts to 132,000 volts bussed on the 132,000-volt side only. Provision is made for two buses, one to which all circuits from both the generators and the outgoing feeders are normally connected through oil breakers and one to which any circuit may be connected by an air break switch. The two buses may be tied together by an oil breaker. The purpose is to provide facility for maintaining the oil breakers and to provide for the rare emergency of bus failure without handicapping the investment by the expense of double oil breakers for each circuit.

Facilities are provided for storing and cleaning the oil by a permanently installed piping system, storage tanks and filter presses. The buses throughout are copper tube and all joints are mechanically clamped as well as sweated to insure good electrical contact. The transformer units are water cooled, with provision for an alarm signal to the operator at the control board in event of failure of the water flow. Indicator valves are provided with hand wheels above the ground line so as to permit ready control of the water supply system.

At Boardman another outdoor station has been constructed through which the new 132-kv. lines bring the energy from Toronto, step it down to 66,000 volts for tying into the existing transmission system; to 22,000 volts for tying into the existing power distribution system; and providing for the extension of the 132-kv. on the future developments in the Youngstown-Sharon area. The transformers tying the 132-kv. to the 66-kv. system are provided with a tertiary winding of 6,600-volt rating, which supplies energy for the operation of a 15,000-kva. condenser.



SCHEMATIC LAYOUT OF PRESENT INSTALLATION

The type of construction is identical with that of Toronto as applying to the steel structure, bus layout and methods of construction. Double buses with a single oil switch and air break jumper are provided for all circuits at 132 kv., 66 kv. and 22 kv.

The condenser is equipped with an automatic voltage regulator so designed and connected as to maintain a constant voltage on the secondary of the transformers, from which transformers the condenser is supplied at a constant voltage within the limits of condenser capacity. The potential for the operation of the "CZ" relays employed on transmission lines is also taken from this source. This potential from the low side is compensated for transformer drop by the use of bushing type transformers on the power transformers so that no high-voltage potential units are required.

The ultimate capacity of this station is approximately 500,000 kva., tying together as it does the Lowellville power plant and the Toronto power plant for the Pennsylvania-Ohio Power & Light Company and being the point of connection between the Ohio Public Service Company and the Pennsylvania-Ohio system for interconnection.

Substation Loads

IN DISCUSSING a paper on "The 60-Cycle Distribution System of the Commonwealth Edison Company," presented by W. G. Kelley before a recent A.I.E.E. convention, E. E. Campbell, also of the Commonwealth Edison Company, states that remote control substations in the Chicago system are usually designed to house seven circuits with provision for enlargement by five additional circuits. Comparative figures for attended and remote control substations on Jan. 1, 1925, show the following distributions of loads and of circuits:

	Attended Sub-station	Remote Control Substation
Maximum load on any one sub-station, kva.	15,000	6,100
Average load per sub., kva.	9,350	3,800
Maximum number of circuits in any one sub.	20	7
Average number of circuits per sub.	11.2	4.8

Figures regarding the nature of the load connected to the 60-cycle circuits have recently been prepared. These figures indicate:

1. That 62 per cent of all the circuits have a maximum load at night, with an annual load factor of 27 per cent.

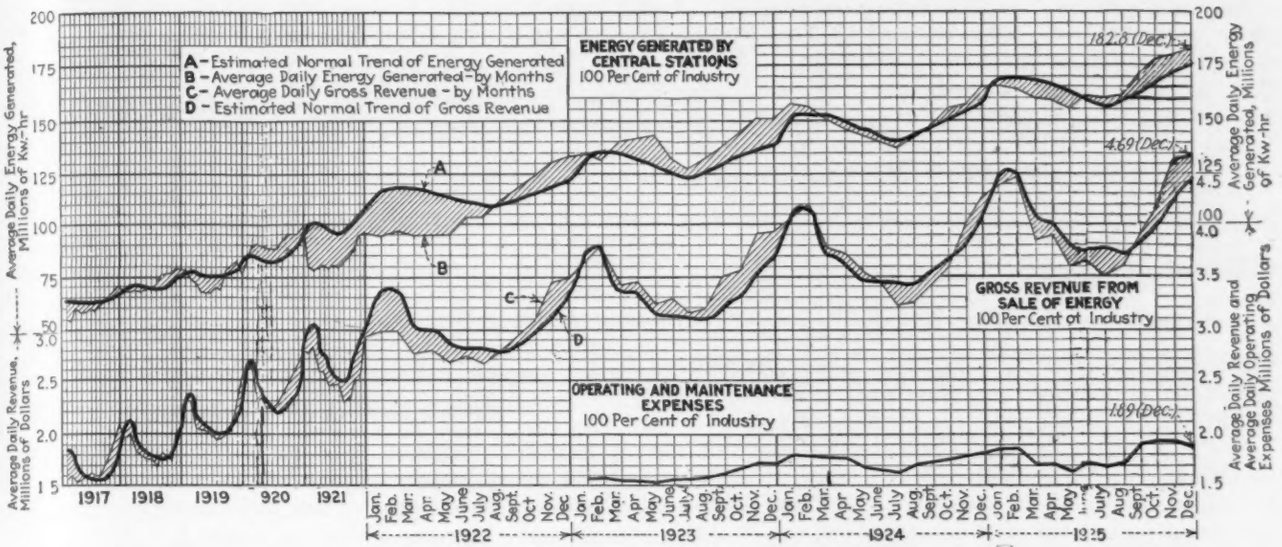
2. That 27 per cent of all the circuits have a maximum load during the day—that is, power load—with a load factor of 42 per cent.

3. That 11 per cent of all the circuits have a day maximum and a night maximum that are approximately equal, with a load factor of 54 per cent.

The latter condition sometimes results in a 5 p.m. maximum load on the circuit. In this case, however, the peak is of short duration and for this reason can be carried with safety even though it exceeds the normal rating of the cable and other circuit equipment.

The possible future omission of induction regulators is something to be hoped for. Much of the complication in a substation is due to regulating the voltage of circuits. Final abandonment of individual circuit regulation will probably come in two or three steps: First, by substitution of 5 per cent regulators for 10 per cent, and then probably regulation of the substation bus. Since the remote control substations receive transmission feed from operated stations, the pressure at the remote control substation will not be as good as at the operated substation, because of the 1.2-ohm reactor in the line between the two substations. The poorer regulation will probably make it necessary to retain some regulation in the remote control substations, especially where the power factor is low.

The circuits, which have a maximum rating of 200 amp., are loaded on the average to about 135 amp. This percentage loading is necessary in order to have capacity to carry the load of other circuits in case of loss of a feeder, and to provide reserve capacity so that reasonable increments of load can be taken on.


A - Estimated Normal Trend of Energy Generated
B - Average Daily Energy Generated - by Months
C - Average Daily Gross Revenue - by Months
D - Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
182.6 (Dec.)
4.69 (Dec.)
1.89 (Dec.)
Average Daily Energy Generated, Millions of Kw.-hr
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses Millions of Dollars
1917 1918 1919 920 1921
1922 1923 1924 1925

THE YEAR 1925 WITNESSED NEW RECORDS IN BOTH ENERGY GENERATED AND IN REVENUE FROM THE SALE OF ENERGY

New Record in December

Output 11.0 per Cent Over That Reported for Last Year—Revenue 12.8 per Cent Above That of December, 1924

THE amount of energy generated by the electric light and power systems of the country totaled 5,659,161,000 kw.-hr. during December, a daily average of 182,800,000 kw.-hr. and a record figure for both average daily and total monthly output. This output is an increase of 11.0 per cent over the output reported for December of 1924 and is 4.8 per cent above the estimated normal for the month, this normal being based upon the operations of the past five years.

The gross revenue from the sale of energy during December was $145,500,000, an average daily revenue of $4,690,000 and another record figure for the industry. This revenue is 5.7 per cent above the estimated normal for the month. These abnormal output and revenue figures are entirely in line with the high degree of industrial activity now prevalent throughout the country.

Of the total revenue it is estimated that $95,000,000, or 62.2 per cent, was received from lighting customers;

TABLE I—OPERATING RATIO OF CENTRAL-STATION COMPANIES

Month	Operating Ratio					
	Steam Plants		Hydro Plants		Combined Hydro and Steam Plants	
	1925	1924	1925	1924	1925	1924
October.....	48.7	48.9	28.0	28.7	45.0	48.2
November....	46.0	46.2	24.8	25.0	42.0	45.0
December.....	45.6	45.8	26.0	27.4	41.8	44.0

TABLE II—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
October....	5,550,289	4,822,582	15.0	4,478,289	3,892,582	1,168,000	1,092,000	2,760,289	2,263,582	550,000	537,000	1,072,000	930,000	994,000	740,000
November..	5,391,813	4,690,975	14.8	4,349,813	3,785,975	1,202,000	1,124,000	2,615,813	2,141,975	532,000	520,000	1,042,000	905,000	938,000	652,000
December..	5,669,161	5,101,792	11.0	4,575,161	4,117,792	1,258,000	1,176,000	2,767,161	2,404,792	550,000	537,000	1,094,000	984,000	1,036,000	710,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR THE THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
October...	$129,800	$112,900	14.9	$83,100	$79,600	$34,200	$22,400	$4,150	$4,400	$8,350	$6,500	$59,750	$54,300
November	139,200	120,700	15.2	91,400	87,600	34,400	22,800	4,720	4,470	8,680	5,830	55,000	51,300
December	145,500	129,000	12.8	95,000	92,400	36,400	25,300	4,800	4,770	9,300	6,530	58,500	55,500

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES ||
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Increase	1925 Short Tons	1924 Short Tons	Per Cent Increase	1925 Barrels	1924 Barrels	Per Cent Increase	1925 Thousands of Cubic Feet	1924 Thousands of Cubic Feat	Per Cent Increase
October.....	1,769,058	1,603,292	10.3	3,781,231	3,219,290	17.4	3,295,768	2,835,885	12.7	811,475	1,365,882	—43.2	4,503,408	6,062,357	—12.2
November..	1,915,832	1,548,366	23.7	3,475,981	3,142,589	10.4	3,061,250	2,892,138	5.8	747,064	1,111,068	—42.0	4,165,512	4,536,881	—25.7
December...	1,931,962	1,724,970	12.0	3,737,199	3,376,822	10.7	3,311,990	3,173,141	4.3	767,708	1,328,668	—33.3	3,643,151	2,940,598	— 8.4

|| As collected by United States Geological Survey. The data are for the electric light and power industry only.

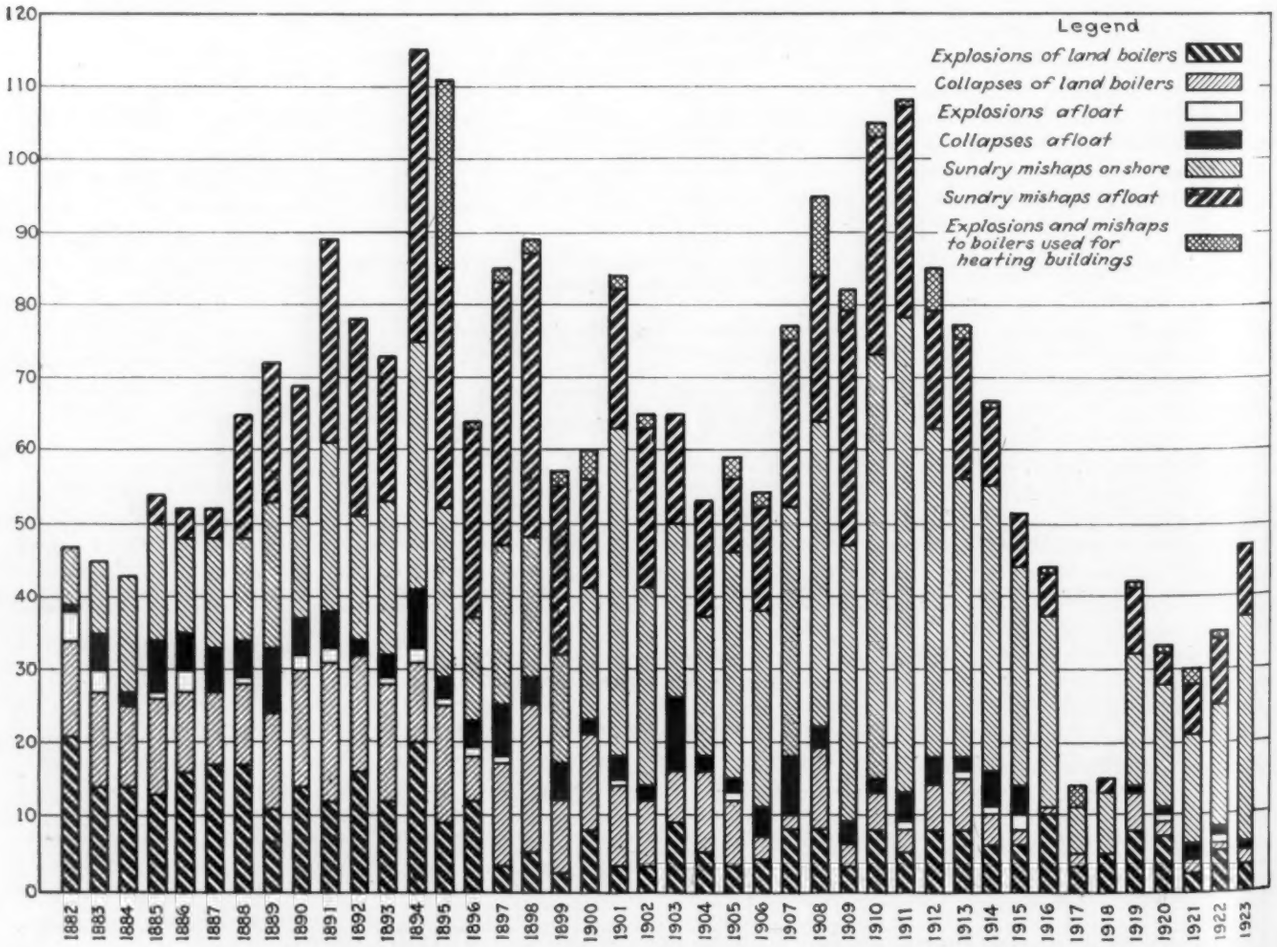
$36,400,000, or 25.1 per cent, from power customers; $4,800,000, or 3.3 per cent, from electric railways, and $9,300,000, or 6.4 per cent, from other utilities.

The high degree of industrial activity throughout the country is reflected in the record consumption of energy by industrial plants in December. During December industrial customers of the country consumed 2,767,-161,000 kw.-hr., which is by far the largest amount of energy ever consumed by industrial power customers in any one month in the history of the industry.

The large decrease in the amount of fuel oil used by the central stations during 1925 has been one of the outstanding facts of the year. During 1924 a total of 16,096,675 bbl. of fuel oil was consumed by the central stations of the country, while during 1925 less than 10 bbl. was used. Only two sections of the country reported a larger fuel oil consumption during 1925 than during 1924.

Causes of Boiler Explosions and Breakdowns of Machinery

EXPLOSIONS of boilers and breakdowns of engines, electrical machinery and all other industrial apparatus are due to deterioration, malconstruction and maltreatment, says the technical report for 1924 of the British Engine, Boiler and Electrical Insurance Company, Ltd., from which the accompanying diagram is taken. They are principally the natural consequences of defects which have not been seen because they have not been looked for, or of wear and tear that has not been remedied in time. The actual condition of a boiler, or any apparatus or machine, can only be ascertained by thorough examination, and as far as is reasonably possible every part should be periodically examined, since any part may be or become defective and thus lead to failure.



ANNUAL NUMBER OF EXPLOSIONS AND OTHER MISHAPS TO BOILERS FROM 1882 TO 1923 INCLUSIVE

Letters from Our Readers

Are Starting Compensators Necessary?

To the Editor of the ELECTRICAL WORLD:

"Are starting compensators necessary?" I would like to give you the benefit of what little experience I have had with motors in the last ten years. I am speaking of motors ranging in size from ½ hp. to 100 hp. and operating on 550 volts, three-phase. Candidly, I cannot see the value of compensators. They reduce excessively the starting torque and are a continual source of trouble from the operating viewpoint. To be rid of double-throw compensators would certainly cut down factory maintenance. Concerning starting larger motors direct from the line I have an incident to relate. We had an oil starter on a 75-hp. motor operating a rubber-mixing mill. This starter became defective, and twice a day the operator had to start the motor directly from the line. How long this condition existed we do not know, but less trouble was experienced in starting and apparently no harm was done to the motor. I should certainly like to hear more of actual tests, so that we all may know practically as well as theoretically how a motor will fare.

J. W. LOVELL.

Collyer Insulated Wire Company,
Pawtucket, R. I.

Education Will Bring Solution of Wiring Problems

To the Editor of the ELECTRICAL WORLD:

When two-thirds of the editorials appearing in one issue of the ELECTRICAL WORLD refer directly or indirectly to wiring, codes, applications and costs, as was the case on Jan. 30, there must be basic reasons why more consideration is being given to better wiring methods. Does not this editorial discussion show the importance of the matter and that there is some reason for the fact that the recent report of the N. E. L. A. wiring committee is being questioned?

Among the various factors to be considered in promoting higher wiring standards and costs are two for primary consideration. The first, as I see it, is the natural improvement in wiring installations both as to quantity and quality. This point was specifically mentioned in your editorial "The Cost of Wiring," and the comparison with the advancing standards in bathroom equipment closely applies. How about other phases of home construction, such as roofing, hardware, paints and glass? Does not each of them show an improvement and consequent increase in cost—and in value to the purchaser?

The second point concerns the varying wiring standards found throughout the country. If it were not for the actual experience obtained where higher standards prevail, it would be difficult periodically to improve and perfect the national code. Moreover, progressive communities cannot be expected to "mark time" awaiting the approach of what might be termed the "going standard" of wiring applicable to average conditions.

Denver is the pioneer "all-metal" city. Consideration is now being given to the requirement of galvanized metal. Safety-type switches will be required in the revised municipal code. The installation of convenience outlets in certain rooms will be made mandatory. Certainly these improvements will add slightly to the cost of the wiring, but this is unlikely to cause a decreased use or appreciation of electric service.

Education is the solution. It is up to the industry to sell its finished service—the joy, the labor saving, the comfort which comes from adequate wiring permitting the fullest use of electric equipment. The electrical industry under these conditions does not suffer. On the contrary, more business is done by each branch, including the central-station company. Who is to judge what constitutes excessive wiring costs?

S. W. BISHOP.

Electrical League of Colorado,
Denver, Col.

Why Transformers Failed in Memphis Substation

To the Editor of the ELECTRICAL WORLD:

In your issue of Jan. 30 you mentioned the trouble which we had on Jan. 18, causing the downtown district in Memphis to be without electric service for a large portion of a day. I think it would be well for the readers of your magazine to know something of the details which caused this interruption to service, as it may be of benefit in preventing similar trouble.

Over the week end we had put into service a new substation, serving the underground distribution system in the downtown portion of Memphis. Several banks of transformers were moved from the old station across the street and put into service at the new substation. These transformers had been in service supplying 2,300 volts, three-phase primary circuits. At the new substation they were connected to give 4,100 volts for three-phase, four-wire primaries. The change in voltage was accomplished by simply turning the handle of the tap changer, as an inspection of the inside portion of the transformers was not deemed necessary. They had been in service only two years and had operated satisfactorily with temperatures always safely within the manufacturer's guarantee. Before moving them the oil had been found in excellent condition.

After going in service in the new location, the load was carried for eighteen hours, until the Monday morning load began to come onto the station, when the transformers failed. The trouble was found to be in the tap changers, the design of which proved to be such that it does not seem possible it could have got through the engineering department of a first-class manufacturer. Details of the design are as follows:

Taps from the middle portion of each phase winding are brought up to the tap changer, which consists of brass rods about 7 in. long arranged in cylindrical form about a central shaft. These rods are held in place by some molded insulating material. The central shaft has an eccentric cam which, when revolved, short-circuits the various taps in pairs, depending on the position in which it is left. The contact area, therefore, is that formed by a cylinder 1½ in. in diameter and 4 in. long in contact with two ½-in. cylindrical rods. In other words, the contact is a straight line.

The transformers which failed are rated at 158 amp. per phase at normal load, so that the tap changers that would have to carry 158 amp. through two contacts each consisted of a single line 4 in. long. We found the tap changers to be heavily coated with burnt and charred oil. They had not failed in their old connection because they were clean and bright when put into service—the excess heat from the contacts had been carried away by the oil. When the positions of the taps were altered at the new substation there was a heavy coating of burnt oil between the contacts, and this was the cause of the failure.

M. ELDREDGE,
Chief Engineer.

Memphis Power & Light Company,
Memphis, Tenn.

Central Station and Industrial Practice

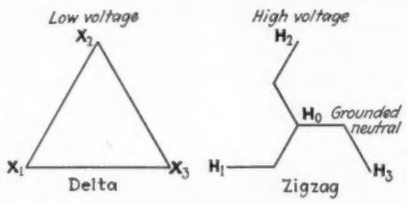
Zigzag Transformers Eliminate Phase Displacement

BY H. W. EALES
Union Electric Light & Power Company, St. Louis, Mo.

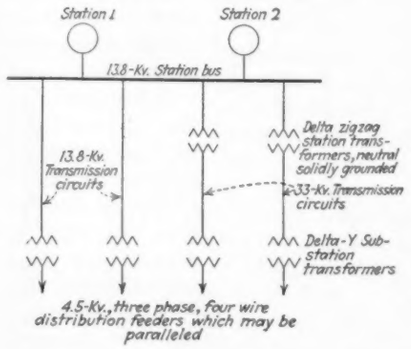
THE employment of the so-called supertension voltages for underground transmission between new power stations and urban or other distribution substations of power systems has introduced new problems in the design of these new transmission systems with respect to the older and lower voltages of the existing systems. The supertension cables of necessity require the grounding of the neutrals of these circuits. Care must be exercised in these new designs to see that the transformation arrangements are properly selected to permit fullest flexibility of the transmission and distribution arrangements from all power sources.

Such a case occurred in the recent expansion of the transmission system of the Union Electric Light & Power Company of St. Louis. Prior to this expansion all urban substations were supplied by 13.8-kv. circuits connected through reactors to the Ashley station bus. The construction of Cahokia station, across the Mississippi River from St. Louis, made desirable the installation of 33-kv. submarine cables connecting to underground cables for supply of power to the urban distribution substations. In the substations the voltage transformation is accomplished by means of delta-Y connected transformers with primaries either 33 or 13.8 kv. delta-connected and with secondaries Y-connected for supply to the 4.5 kv., three-phase, four-wire grounded neutral distribution system.

Each 33-kv. circuit was connected to the 13.8-kv. station bus through an individual three-phase transformer; 7,500-kva. transformers for transmission between station and substation, and 12,000-kva. for tie lines between stations. To eliminate phase displacement between 13.8-kv. and 33-kv. transmission circuits, these transformers were provided with delta zigzag windings, the 13.8-kv. primaries being delta-connected and the 33-kv. secondaries being zigzag connected. Since the transformation inside the substations supplied by either transmission voltage is identical in phase displacement, the phase angle of the outgoing 4.5-kv. distribution feeders from different substations is identical and the feeders may be paralleled. The use of zigzag transformer connections to the 33-kv. circuits provides for solidly grounding the neutral of each circuit. Also the use of an individual transformer for each circuit, instead of supplying the circuits from a common 33-kv. bus, reduces the maximum short-circuit currents of each circuit to a very low value.



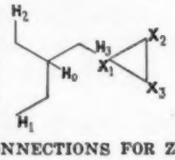
VECTORIAL REPRESENTATION OF DELTA ZIGZAG TRANSFORMER

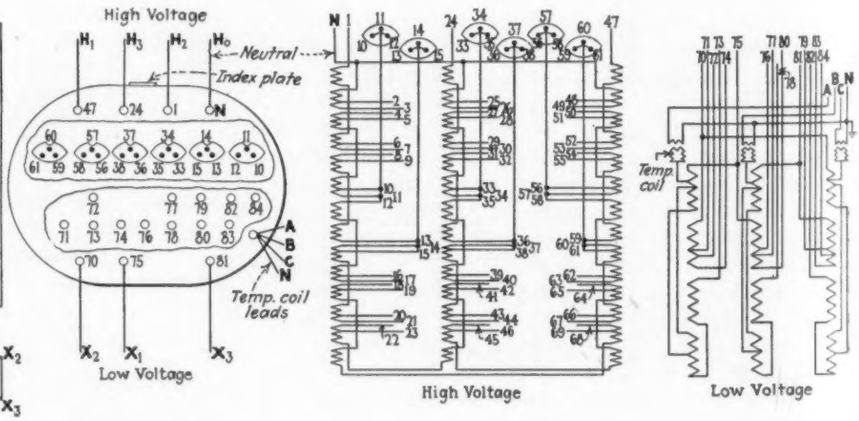

Station 1
Station 2
13.8-Kv. Station bus
13.8-Kv. Transmission circuits
Delta zigzag station transformers, neutral solidly grounded
33-Kv. Transmission circuits
Delta-Y Substation transformers
4.5-Kv., three phase, four wire distribution feeders which may be paralleled

DELTA ZIGZAG TRANSFORMERS PERMIT OPERATION IN PARALLEL OF CIRCUITS CONTAINING DIFFERENT NUMBERS OF TRANSFORMERS AND ALSO PERMIT GROUNDING OF NEUTRALS

High-Voltage Connections		
Lines on 1, 24 and 47		
Volts	Amp.	Connect
33,000	209	3 to 4, 7 to 8, 11 to 12, 13 to 14, 17 to 18, 21 to 22, 26 to 27, 30 to 31, 34 to 35, 36 to 37, 40 to 41, 44 to 45, 49 to 50, 53 to 54, 57 to 58, 59 to 60, 63 to 64, 67 to 68
31,350	221	3 to 4, 7 to 8, 10 to 12, 13 to 15, 17 to 18, 21 to 22, 26 to 27, 30 to 31, 33 to 35, 36 to 38, 40 to 41, 44 to 45, 49 to 50, 53 to 54, 56 to 58, 59 to 61, 63 to 64, 67 to 68
27,600	251	2 to 5, 6 to 9, 11 to 12, 13 to 14, 16 to 19, 20 to 23, 25 to 28, 29 to 32, 34 to 35, 36 to 37, 39 to 42, 43 to 46, 48 to 51, 52 to 55, 57 to 58, 59 to 60, 62 to 65, 66 to 69
25,950	266	2 to 5, 6 to 9, 10 to 12, 13 to 15, 16 to 19, 20 to 23, 25 to 28, 29 to 32, 33 to 35, 36 to 38, 39 to 42, 43 to 46, 48 to 51, 52 to 55, 56 to 58, 59 to 61, 62 to 65, 66 to 69

Low-Voltage Connections		
Lines on 70, 75 and 81		
Volts	Amp.	Connect
13,800	502	73 to 74, 78 to 80, 82 to 83
13,200	525	72 to 73, 77 to 78, 82 to 84
12,600	550	71 to 73, 76 to 78, 79 to 82





CONNECTIONS FOR ZIGZAG TRANSFORMERS USED TO AVOID PHASE DISPLACEMENT

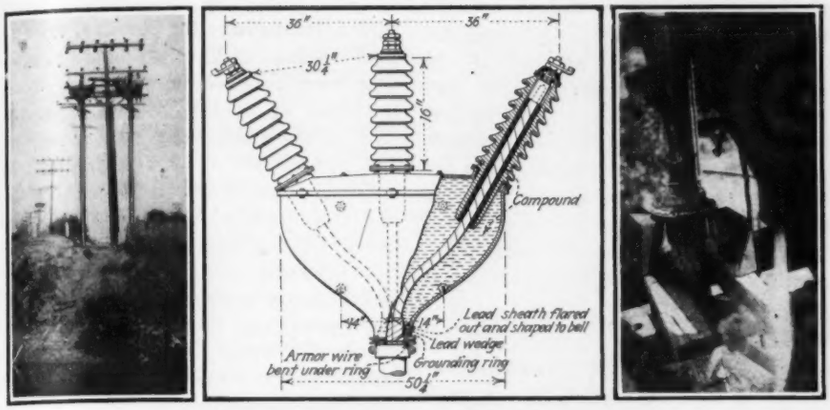
44-Kv. Pothead Assembly

BY G. H. HAGAR
Assistant to the Superintendent Great Western Power Company, San Francisco, Cal.

THE great amount of care necessary in assembling a pothead for a three-conductor 44-kv. cable is shown by an installation made recently by the Great Western Power Company. Two three-conductor, lead-covered submarine cables designed to carry 100 amp. at 44,000 volts or 7,000 kva. each on a grounded neutral system were installed across the Napa River at Napa, Cal., in May, 1925, and since last August have been operating satisfactorily at full rated voltage.

The physical make-up of the cables is as follows:

$\frac{13}{32}$ in. hemp core.
22-strand, 76,000 circ.mil copper cable.



DETAILS OF INSTALLATION OF 44-KV. POTHEADS

Left—Completed installation. Dead end pole is 20 ft. behind cable structure.
Center—Pothead assembly for three-conductor, 44-kv. submarine cable.
Right—Lower part of 44-kv. cable terminal assembly. Note the armor wires bent over the clamping ring to take the entire weight of the cable; the grounding ring and lead wedges, and the lead sheath belled out, to be shaped later to the inside wall of the main pothead casting. The belt insulation has been stripped and the insulation around each conductor run to the top of the bushing without being disturbed.

$\frac{13}{32}$ in. of 5-mil paper around each conductor.

$\frac{6}{32}$ in. of 5-mil paper belt insulation.

$\frac{1}{8}$ in. lead.

Two layers of 0.0333-in. reinforced rubber tape, edges butting and layers overlapping.

One layer protective tape.

One jute serving.

No. 3 BWG galvanized steel armor wires.

Length, 360 ft. each.

Outside diameter, 4.3 in.

Weight, 21 lb. per lineal foot.

Voltage test, 90,000 volts between conductors and 55,000 volts to ground for five minutes.

In installing the potheads extreme care was taken to ground the lead sheath to the armor wires, as it is partly insulated by the jute and rubber tape; also to shape the lead sheath to the wall of the main casting to prevent a heavy electric static field being formed at the crotch where the conductors start to fan out. The details of the pothead assembly are shown in Fig. 2. When the terminal was completely assembled, the casting was heated with hand torches and the compound poured in, using a funnel higher than the bushings. The casting was kept heated until it and the bushings were entirely filled and then allowed to cool from the bottom upward, keeping the upper part heated until last and adding compound as shrinkage took place. The work of filling the pothead required three hours, after which the temperature was gradually reduced over a period of twelve hours.

Because of the unusually high voltage of the cables it was necessary to take these precautions to prevent air pockets in the pothead and ultimate breakdown of the cable.

Air Used to Operate Large Oil Circuit Breakers

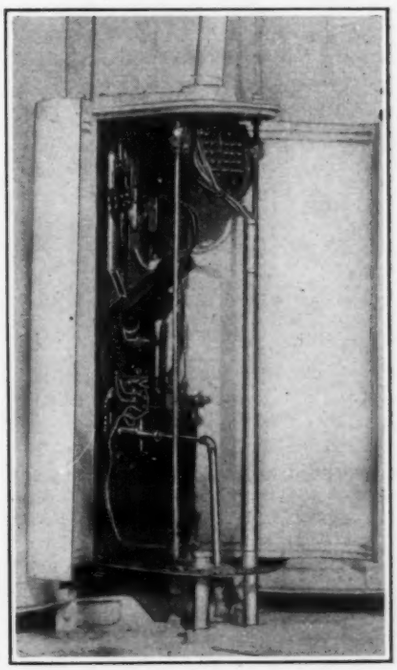
BY ERNEST K. SADLER
Operating Department, San Joaquin Light & Power Corporation, Fresno, Cal.

BECAUSE of the large amount of power and the large storage batteries required to operate oil circuit breakers there is a very definite trend to replace solenoid-operating mechanisms with some device that operates from stored mechanical energy. On the system of the San Joaquin Light & Power Corporation compressed air has been used with success at several substations.

At the LeGrand substation, so equipped, there are one 66-kv., four 110-kv. and five 15-kv. oil circuit breakers, all of which are of a heavy duty type. The power required to close the 15-kv. breakers is around 5,800 in.-lb. and for the 110-kv. switches it is 12,000 in.-lb. When the substation was designed, it was evident that a very large capacity storage battery would be needed if solenoid-operating mechanisms were used. The experience of this company has been that large storage batteries are expensive to maintain, and it was decided to use compressed air to close the circuit breakers. A motor-driven air compressor with automatic pressure switch set to cut in at 100 lb. and out at 120 lb. was installed. Two air storage tanks, each approximately 18 in. in diameter and 48 in. long, were installed, to insure an adequate air supply in case of interruption of service to the compressor motor. One tank was placed near the 15-kv. breakers; the other was centrally located with reference to the high-tension switches.

The switch manufacturer supplied the air-operating mechanisms, which are equipped with solenoid-operated three-way air valves. The air valve solenoids as well as trip coils are wound for 6 volts. One 80 amp.-hr. storage battery kept on trickle charge supplies power to operate the air valves from remote control switches, to trip the circuit beakers, light the indicating lamps, operate the automatic reclosing relays on the feeder switches and ring the alarm bell. In order not to drain too heavily on the battery, telephone type indicating lamps with $\frac{3}{4}$-in. red and green jeweled bull's-eyes were used. These lamps draw only 0.1 amp. each.

On two substations equipped with these air-operated mechanisms the cost of installation was considerably less than for solenoid-operated and storage battery-operated switches. However, the air installations have required more attention and maintenance than solenoid and battery installations. The 110-kv. breakers trip out in about ten cycles mechanical time, but are slower in closing than the solenoid-operated breakers. However, this time of closing is arrived at only by comparison with some 70-kv. four-break switches of the same type.



AIR OPERATION OF 110-KV. OIL CIRCUIT BREAKERS SAVES LARGE CAPACITY STORAGE BATTERY

Power for operating air valves and indicating lamps is supplied by a 12-volt, 80 amp.-hr. storage battery.

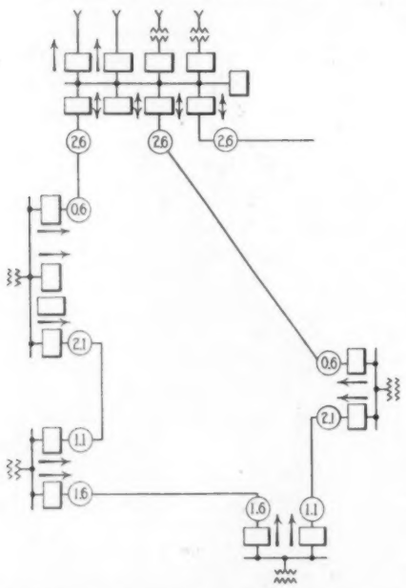
The San Joaquin Light & Power Corporation's experience with air

operation has been such as to warrant its further extension, and the high-tension switches at two substations that will be enlarged during the coming year will be air equipped.

Relaying Loop with Several Power Sources

REVERSE power relays with overload inverse time protection have been used successfully on a 33,000-volt loop in Illinois, having generating stations at several points on the loop. The nature of the loop, locations of power plants, positions and settings of relays are indicated in the accompanying illustration. The success of operation, in the opinion of the company, is attributable to the sequence of relay time settings.

All relays are set for the same current, and selective action is obtained not only by a difference in time between the successive relays but by the sequence of the settings. For example, it will be observed from the accompanying illustration that by starting at any point on the loop the time settings of the relays in the circuits leaving each station in a clockwise direction decrease by a difference of 0.5 second around the loop. The difference of 0.5 second includes the operating time of relay and circuit breaker. The time settings of the relays in the circuits leaving the station in a counter-clockwise direction differ by the same period of time, but increase from the minimum setting if the circuits are traced around the loop in the same direction as in the first instance. By thus providing ascending and descending time settings for the two groups of relays at each station, selective operation is obtained in opposite directions. This arrangement works very satisfactorily except when more than one fault occur coincidentally.



SEQUENCE OF TIME SETTINGS FOR REVERSE POWER RELAYS HAVING OVERLOAD INVERSE TIME ELEMENTS TO PROTECT LOOP IN ILLINOIS

Reverse power relays connected to trip when power flows in direction indicated by arrows.

To operate the relays, bushing-type current transformers are used on the oil circuit breaker terminals. Type IK-108 reverse-power relays with type IA-205 overload relays having an inverse time element are employed. It would also be possible to employ this scheme using Type CR single-phase reverse-power relays which have an inverse time element.

Overexciting Synchronous Motors Is Economical

BY ARTHUR H. WEGNER
Washington Water Power Company, Spokane, Wash.

IN THE Post Street substation of the Washington Water Power Company, Spokane, Wash., there is approximately 11,000 kva. in motor-generator units for supplying the Edison and railway load. Five of the units, or about 8,500 kva. capacity, are synchronous motor driven and the possibility of improving power factor by overexciting the synchronous motors seemed very attractive.

Before the field current on a synchronous motor can be permanently raised above the full load unity power factor value, two questions must be considered: First, what will be the effect of the greater stator current upon the heating of the machine, and its relation to the allowable temperature limits? Second, will the field windings safely carry the current necessary to overexcite the motors the required amount? These machines are of the old 35 deg. C. temperature rise rating, and since they were built the A.I.E.E. standardization rules have increased the allowable temperature rise on the class of insulation employed to 50 deg. C., based on an ambient temperature of 40 deg. C.

Observed temperatures on heat runs were well within the safe heating limits, and in consideration of the facts that the ambient temperature is 30 deg. C. instead of 40 deg. C. and that the machines already had a rating of 150 per cent of full load rating without exceeding a 50 deg. rise based on an ambient temperature of 40 deg., it was decided to give the machines a new rating of 125 per cent of the original overload rating. Tests showed that the synchronous motor fields would safely carry all the current that could be put through them with the exciter bus voltage maintained as for normal operation. From full load "V" curves the value of field current required at the new rated stator current was determined.

Because the peak load lasts for but a small portion of each day, the machines will be subjected to the higher rating for only about the same length of time as for the original rating of 150 per cent. From this investigation it was found that approximately 6,000 kva., or 75 per cent of the rating of the machines, is available for power-factor correction. In short, the equivalent of a 6,000-kva. synchronous condenser was made available at no additional expense except the increased I^2R loss in the stator and fields. In fact, if this reactive kilovolt-amperage had not been available, it would have been necessary to install a synchronous condenser of approximately 6,000-kva. capacity in the near future.

Wires, Trees and the Public

BY G. D. BLAIR
Forestry Department, Consumers Power Company, Jackson, Mich.

THE tree problem will be present as long as power is transmitted by overhead conductors and economy of construction is considered. Continuity of service, public safety and good will are unquestionably aided or hampered by tree conditions. Tree trimming for power line clearance and safety is therefore a legitimate and indispensable act on the part of electric-utility companies, and responsibility for obtaining and maintaining adequate tree clearance in public and private places has long been vested in the companies themselves. Civic authorities and individuals are willing to concede this privilege because of their desire for public improvement, but they have a right to insist that the work be thoroughly and intelligently administered.

It should not be necessary for construction and operating men to look upon their tree problems with apprehension. Trim the trees with the same degree of skill exercised in

meter settings and line construction, and the tree question will resolve itself into recognized routine work. A solution for this problem will generally involve the following factors: (1) competent foremen, skilled in tree work and in charge of permanent crews; (2) proper tools and equipment; (3) honest, intelligent agreement with each individual property owner and with civic authorities before work is begun. It should be kept in mind that conservation of trees is a direct public contract, also that years of ruthless trimming by willing but incompetent linemen has, in the public mind, tainted the situation. Replace antiquated, butchering methods with systematic, scientific, skilled workmanship supplemented by kind but firm consideration of individual rights, and highly desirable results will be obtained.

Capable foremen should aid in selecting pole heights and pole locations adjacent to trees. Thus, fundamentally, the conditions are made right to obtain adequate tree clearance by trimming. The property owner and civic authorities are then approached and a friendly understanding, either verbal or written, is effected. Confidence is inspired in the public's mind through discussion of treatment of its trees with trained tree men. Honest agreement carried out to the letter further assures satisfaction on the customer's part, and the pleasing appearance of the finished operation eliminates future difficulties occurring under similar conditions.

Special tools are of primary importance in the actual execution of the work from the standpoints of economy, good workmanship and safety. Consideration given to tree symmetry, dead, broken and interfering limbs, thinning and the general welfare of the tree invites favorable comment and lessens future costs. Small crews of five to seven men have proved most successful under normal conditions. Never use spurs on live trees. Neatness of completed operation by removing all cut limbs from trees, hauling brush, leaving no stubs to decay and painting all wounds are important details.

Line construction on private rights-of-way requires fewer trees to be trimmed and more to be removed than does construction on public highways. The same policy, however, should prevail. Standard clearances of 5 ft. on primary distribution lines, 7 ft. on 40,000-volt transmission lines and 10 ft. on higher voltages are considered sufficient under most conditions.

FIG. 4—TREES TOPPED BACK 15 TO 18 FT., BUT FEW SIGNS OF TRIMMING ARE APPARENT. NOTICE LARGE AMOUNT OF CLEARANCE

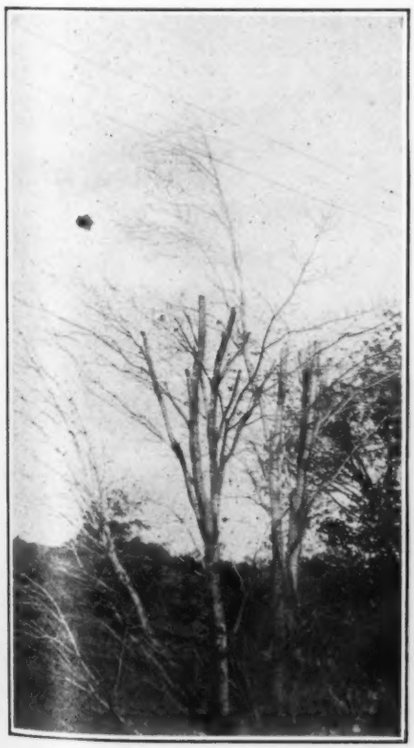


FIG. 1—SOFT MAPLE TREES IMPROPERLY TRIMMED BY CONTRACTOR

FIG. 2—SAME TREE AS SHOWN IN FIG. 1, TRIMMED BY POWER COMPANY

FIG. 3—EFFECT OF RUTHLESS TRIMMING BY UNTRAINED MEN

Commercial Activities and Public Relations

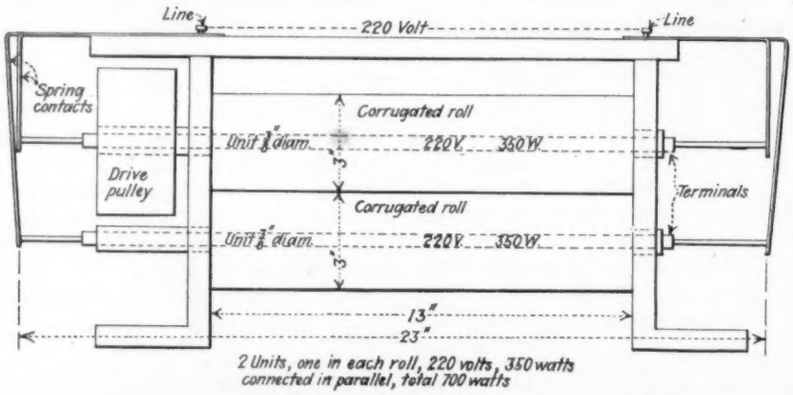
Electric Heating of Cardboard Rolls Saves $2,000 a Year

BY WALTER A. CHURCHILL
Engineer Dalton Electric Heating Company, Salem, Mass.

THE installation of electrically heated rolls for corrugating pasteboard in a crayon factory has eliminated the use of a filler card formerly required to take up extra corrugations and will have paid for itself ten times over in the first year's service. The manufacturer of the crayons sells largely to five- and ten-cent stores and had been using corrugated pasteboard to provide individual receptacles for each crayon in the selling packages. The house was unable to obtain pasteboard with the correct size and number of corrugations and so used a filler at a cost of about $2,000 a year. The crayon maker decided to produce his own corrugated board and for this purpose built a machine consisting of two interlocking gear-toothed rolls with the necessary bearings and frame, the idea being to run the cardboard through the rolls, the teeth shaping the cardboard to the required form. With the machine used cold, the cardboard always flattened out to a large extent no matter how much pressure was employed, and in addition was very limp after coming out of the rolls.

To meet this situation it was decided to heat the machine electrically. The rolls were only 3 in. in diameter and the bearings ¾ in., hence a very "slim" unit was required. A hole was drilled through each roll along the axis large enough to take a ⅜-in diameter heating unit extending the length of the roll (13 in.) and having terminals at each end. The heating unit turns with the roll and its terminals are in contact at each end with metal strips serving as brushes, the over-all length of the unit, including terminals, being 23 in. Each unit is rated at 350 watts, 220 volts, and the two units are connected in parallel. The roll temperature is about 350 deg. F., and the machine consumes about 6.25 kw.-hr. per day at an energy charge of four cents per kilowatt-hour.

Approximately one million pieces of cardboard are handled per year, and the machine cost less than $200 installed. The machine was a complete success after the heat was applied, because cardboard when formed with a little pressure over a die or other special shape has the property of retaining that shape with all its original strength and stiffness.



METHOD OF ELECTRICALLY HEATING CORRUGATED ROLLS

Long Service—A Measure of Working Conditions

NEARLY 170 men were listed as members of the Quarter Century Club of the Commonwealth Edison Company at its last (eighth) annual meeting. Membership in this club, as its name indicates, includes only men who have rendered 25 years of service or more to the company and are still in active work.

More impressive still are the number of active employees who have completed five, ten, fifteen and twenty years of service. For example, 1,780 are in the five to ten year class, 607 in the ten to fifteen year class, 485 in the fifteen to twenty year class, and 405 have completed more than twenty years of service.

Based on the total number of employees now in the company, approximately 37 per cent have been in service more than five years, 17 per cent more than ten years, 10 per cent more than fifteen years, 5 per cent more than twenty years and 2 per cent more than twenty-five years. Analyzed in terms of the employees who were on the payroll in December, 1920, 56.6 per cent of these were still in service in December, 1925. These conditions result despite the fact that labor and clerical help are included, where, as a general rule, most companies have their greatest turnover.

These results are attributed to the various ways in which the company has manifested an interest in the development and personal problems of its representatives.

Byllesby Company's New Management Magazine

THE tendency toward grouping a number of electric utilities under one management that has developed so markedly in the last two or three years has brought with it the problem of maintaining close relations not only between the headquarters holding company and the subsidiary companies but also between the local properties themselves. As an aid in bringing these local organizations in closer touch with one another and with its headquarters staff in Chicago the Byllesby Engineering & Management Company has started the publication of a company magazine, *Byllesby Management*.

The policy of this publication will be more comprehensive and broader in scope than is ordinarily undertaken by a company magazine. The plan is to publish and discuss facts and opinions that may be of interest to the managements and employees as well as to the customers or the public. The importance of bringing about the closest possible relations of this sort is shown in the Byllesby

company's experience that the more closely the different plants under the same management can be kept in touch with one another the more uniform their practices will become and the more efficient will be their methods of operation. The publication of the magazine is expected to go far in accomplishing these results.

In the first number of *Byllesby Management*, just issued, a high editorial standard has been established and the magazine contains a great amount of information on company policy and practice that will prove invaluable to all Byllesby men throughout the country.

Electric Furnaces Show Good Results

FOR nearly two years the Century Electric Company of St. Louis, manufacturer of electric motors, has used two Detroit electric furnaces, Type L. F. 200-250, to melt brass and phosphor bronze for castings. These castings have consisted of brush holders, end caps, rings, rivets, fans and bearings, and the quality obtained by the use of the electric furnaces has been of the highest. Gas and gas-fired pit furnaces were used before the installation of electric furnaces and the company has made a saving of 50 per cent in melting cost with electric heat besides obtaining a better product, better production and better operating conditions. Table I gives the melting cost per ton of brass or phosphor bronze during 1925.

The furnaces are operated with two nine-hour shifts, and twenty-five 250-lb. heats per eighteen-hour day have been obtained from the two furnaces. In the morning the heats sometimes require from one and a half to two hours, but later in the day this time is reduced as low as 20 to 30 minutes. A charge of phosphor bronze can be melted more quickly than one of brass, and a charge of scrap and borings takes longer than one of ingots. It has been found desirable to have an electrician available, but only a very small amount of his time has been required to keep the furnaces in service. Removal of linings and other necessary mechanical maintenance have been carried out at such times that they have little effect on production.

Due to the satisfactory results in melting brass and bronze, a ½-ton Pittsburgh electric furnace was installed in the spring of 1925 to melt combination charges of cast-iron scrap, cast-iron borings, steel turnings, baled sheet iron, steel punchings and foundry returns. The small and medium size frame, end bracket, flange and ring castings so far attempted have been characterized by strong and solid iron and have been of ready machinability. Some castings with as much as 30 per cent steel in the melt have been as readily machinable as straight gray iron castings purchased from other foundries. The only trouble due to blowholes was met when the melt was one closely approaching gray iron. Any lack of uniformity in ma-

TABLE I—MELTING COST PER TON OF BRASS AND PHOSPHOR BRONZE PRODUCED BY ELECTRIC FURNACE

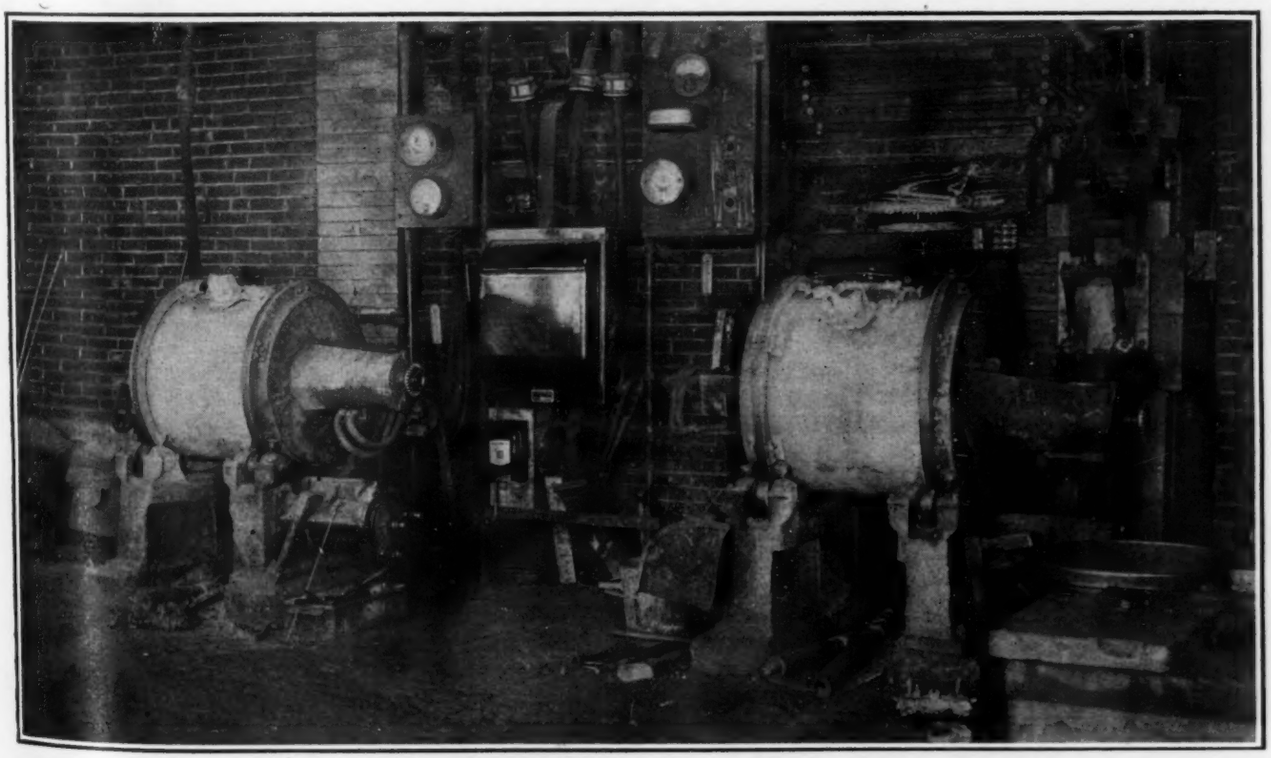
Power cost, 270 kw.-hr. at 1¼ cents per kilowatt-hour	$3.38
Metal loss, 1 per cent	1.60
Electrodes, 6.38 lb.	1.41
Lining	0.55
Labor, 4.8 hours	3.60
Depreciation, 10 per cent per year, production 455 tons	1.32
Total*	$11.86

*This total is an average value for cost, as about 50 per cent of output was phosphor bronze and the other 50 per cent was brass.

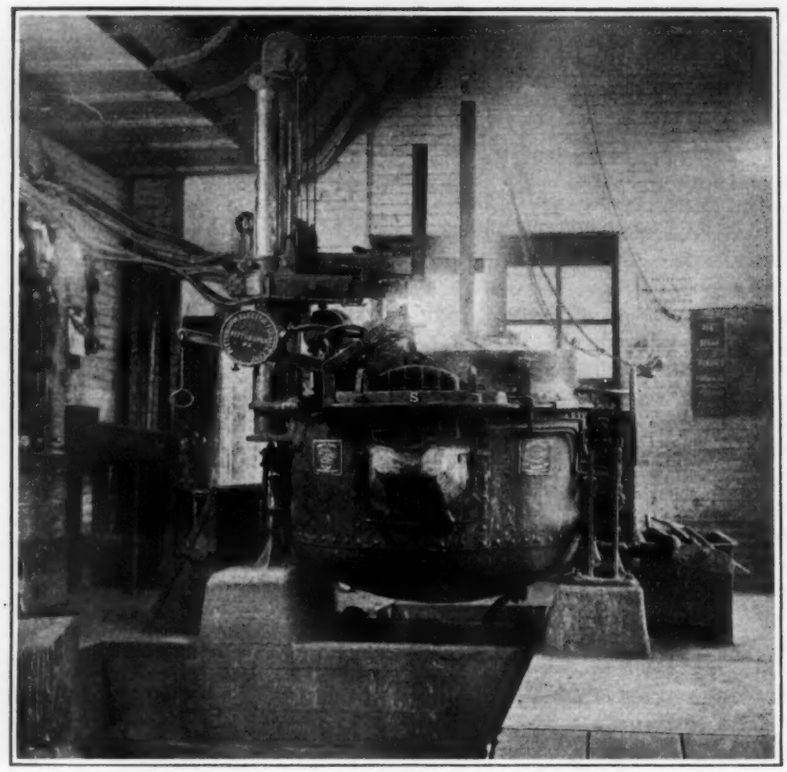
TABLE II—MELTING COST PER TON OF IRON AND STEEL PRODUCED BY ELECTRIC FURNACE

Power cost, 575 kw.-hr. at 1¼ cents per kilowatt-hour	$7.20
Metal loss, 8 per cent	2.40
Electrodes, 4½ lb.	0.99
Lining	0.61
Labor, 2.64 hours	2.50
Depreciation, 10 per cent per year, production 2,700 tons	0.78
Total*	$14.48

*This total is higher than customarily might be expected, because by using loose borings and turnings there is a tendency for them to float on the slag and retard the melting.



ELECTRIC BRASS-MELTING FURNACES IN USE AT CENTURY ELECTRIC COMPANY



CASTINGS HAVE BEEN IMPROVED BY THE USE OF THIS ½-TON IRON AND STEEL ELECTRIC FURNACE

chinability has been largely found in castings with adjacent portions of widely different sectional areas, and has also been due to inexperience in pouring rather than in the metal itself. A crew of operators has been trained in the plant, and the product is being constantly improved.

The furnace is worked with three eight-hour shifts, and twelve heats per day are practicable and fourteen heats possible. Relining the furnace is a sixteen-hour Sunday job and has not interfered with production. A very small amount of work is required from the electrician, and the melter's helper is also able to do miscellaneous foundry work between heats.

The melting cost plus the cost of the metals used and the ingredients added such as carbon, silicon and small amounts of ferromanganese is a little higher than the cost of gray iron castings purchased from other foundries, but the cost is being steadily reduced and it is expected that in a short time the production cost will be a little lower than the purchase price of castings. It was estimated when the furnace was installed that it would require a year to train the operators to produce satisfactory castings at outside cost, but this has been accomplished in six months, so that better quality castings for the requirements of the company are now being made and there is constant improvement with decreasing costs. Table II gives the average melting costs per ton produced to date. The company is entirely satisfied with results obtained from electric heat and plans are now being made to increase the installation for both types of melting.

Illinois Utility Serving Public by Radio

TIMELY tips to housewives on the preparation of foods and general household supervision will be broadcast by the home service department of the Public Service Company of Northern Illinois from radio station WORD every Tuesday evening between 7 and 7:45. Mrs. Eva Hawkins Shanks, director of the home service department, will be the speaker.

This announcement covers only a portion of a radio broadcasting schedule recently instituted by the company and made possible through the courtesy of the International Bible Students Association of New York City, owner and operator of Station WORD.

Home-service talks, interspersed with entertainment numbers, will occupy the early evening sessions on Tuesday, but from 11 to 11:45 radio fans will be given the opportunity to hear short selected talks on topics of general interest designed to have a universally popular appeal. This series of discourses also will be seasoned with musical selections, arranged under the supervision of Morgan L. Eastman, director of the Edison Symphony Orchestra.

Launches Rural Advertising Campaign

ENCOURAGED by the success it has met in supplying electric service to thousands of rural consumers in its territory, the Milwaukee Electric Railway & Light Company has adopted new plans which have for their object greater expansion and enlargement of its rural lines operations.

It will attempt to reach its goal of electrifying every farm in the territory it serves by launching a regular advertising campaign in the agricultural magazines and weekly newspapers for farmers' electric business.

The first two of these farm electrification advertisements, one of which is here reproduced, will be published twice in thirteen weekly newspapers, and the other will appear five times in two Wisconsin agricultural magazines and eleven times in thirteen local newspapers during February, March and April.

Now at Your Door!
Electric Service at Usable, Reasonable Rates
Big Rural Electrification Project
Including Your Neighborhood, Launched by the Milwaukee Electric Railway & Light Company
A TREMENDOUS PROGRAM. Its object, to electrify every farm in the territory the Company serves. To supply this service on a low rate basis enabling the farmer to use electricity freely and cheaply — to milk his cows, separate cream, pump water and safely light his home, barn and barnyard, and enable the farmer's wife to cook, bake, wash, iron and clean with the same facilities that are enjoyed by her city neighbors.
A Deferred Payment Plan and Full Co-operation on the Part of the Company Solves the Problem of Meeting Line Extension Costs
This plan provides the farmer with ample time to meet his share of line extension cost. A plan that irons out all barriers and which involves generous co-operation on the part of the Company.
Central Station Service More Advantageous and Economical Than "Farm Plant" Service
Individually owned "electric plant" service is practically limited to lighting. "Central Station" service, on the contrary, supplies ample average power requirements — power sufficient to operate the motors and mechanical equipment on the average farm. Also, such electric household appliances as an electric range, washing machine, vacuum cleaner, iron, heater, fan, etc. Then, too, "Central Station" service requires no maintenance or upkeep on the part of the farmer. Nothing to worry about. Just snap the switch and the service is on the job. The Company maintains the line and service on its extensions.
For further information telephone, call or write. A representative will be glad to call upon you without expense or obligation to you.
THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY
PUBLIC SERVICE BUILDING MILWAUKEE, WISCONSIN

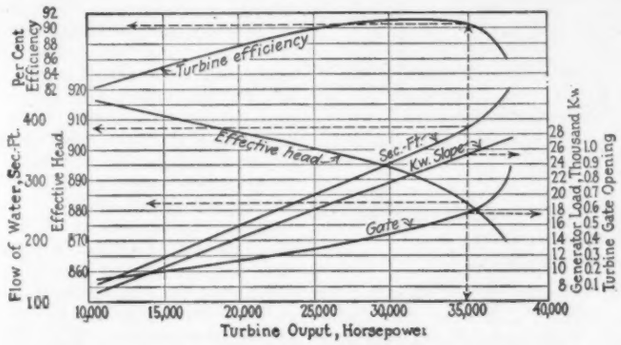
BRINGING ADVANTAGES OF ELECTRIC SERVICE TO NOTICE OF POSSIBLE RURAL CUSTOMERS

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Efficiency Test on High-Head Reaction Turbine.—Test data are reported on Unit 1 in the Oak Grove plant of the Portland Electric Power Company. The turbine is a vertical reaction wheel rated at 35,000 b.-hp. and designed for highest efficiency under a head of 849 ft. at 514 r.p.m. In the test the head was 882 ft. The results are summarized in the chart reproduced below.—*Engineering News-Record*, Jan. 7, 1926.

Electrical Progress in Sweden.—GEORGE BROCKNER.—This article gives in compact form statistics on electrical power developments in Sweden. There has been a very rational, systematic and nation-wide exploitation and distribution, due both to the State's foresight and to private initiative, based on exhaustive study. With regard to demand for and supply of electrical energy the country has been divided into three districts—(a) lower and central Sweden, where the supply will by degrees become inadequate to meet the consumption and to which it will therefore be necessary to transmit power from elsewhere; (b) lower north Sweden, where for a distant future there will be a surplus; (c) upper north Sweden, where a substantial surplus can be reckoned on, but the transmission of which to the southern parts of the country will for a long time be technically impracticable. The total estimated available energy with an ordinary volume of water is somewhat over 42,000,000,000 kw.-hr. for the year, distributed among the three districts roughly in the proportion of nine, thirteen and twenty. This assumes complete weekly and day-and-night regulation for the best exploitation. The requirements for the corresponding rural districts for 1940 are expected to be respectively 250,000 kw. and 465,000,000 kw.-hr., 22,000 kw. and 50,000,000 kw.-hr., and 13,000 kw. and 30,000,000 kw.-hr., or an annual total of 545,000,000 kw.-hr., while the total urban and industrial demand at that time will be about a billion kilowatt-hours. In addition the railway requirements for 1940 are taken at 350,000 kw. and 875,000,000 kw.-hr., the total consumption for that year being about 8,600,000,000 kw.-hr., or about one-quarter of the total available. Other problems considered are that of heating and the matter of transmission. The information here quoted appears to have been abstracted from a very comprehensive report of the Royal Electrification Committee, embodying the result of more than six years' work.—*Electrician* (*England*), Jan. 8, 1926.



CHARACTERISTICS OF OAK GROVE REACTION TURBINE

Generation, Control, Switching and Protection

Transformer and Switch Oils.—D. V. ONSLOW.—The properties of transformer oils are reviewed as to viscosity and solidification points, flash point and sludge formation. On these qualities data are presented. In the latter part of the paper various sludging tests are compared, that is, laboratory tests whereby an oil's tendency to form sludge under operating conditions can be estimated in advance. Those discussed are the Michie (B.E.S.A.), which is considered at length; the Brown-Boveri, the American life test, the iodine-value and the surface-tension test. From tests carried out lately in Sweden it has been claimed that the presence of an electric field has a very considerable influence on the reaction which takes place and that the amount of sludge and acid is greatly increased. As a result a new test has been suggested in which the oil is to be maintained at 100 deg. C. under an electric field of 10 kv. per centimeter, while oxygen is bubbled through the oil at the rate of 1 liter per hour, copper and iron being used as catalysts. The period of heating is fixed as 100 hours.—*World Power*, January, 1926.

General Considerations in Parallel Operation of Power System.—A. LINDSTRÖM.—The author discusses the fundamental principles involved in the usual methods of facilitating energy transfer between different power systems. After a discussion of the two main types of connections between systems—viz., the synchronous and the non-synchronous connections—he describes a few methods that have been proposed and used recently, involving induction and commutator machines.—*Teknisk Tidskrift* (*Swedish*), *Elektroteknik*, Jan. 2, 1926.

Transmission, Substations and Distribution

Herkolite Insulating Materials in Transformers.—V. M. MONTSINGER and W. S. MOODY.—Experience has demonstrated that the maximum dielectric strength as well as the maximum mechanical strength of any fibrous insulating material can be obtained by cementing together under great pressure a number of very thin laminas of the material. However, under some conditions the slightest trace of a solvent produces undesirable results. A laminated insulating material, named "Herkolite," has been produced which is free from this defect. Its dielectric strength, in kv., with comparative values for other materials, all in thicknesses of ¼ in. and tested in oil for one minute at 60 cycles, is given in the table. Mechanically it has about four and one-half times the crushing strength of oak in the direction of the grain and fifteen times its strength across the grain, while in tension a result about one and four-tenths times as great as the tension value for oak is reported.—*General Electric Review*, February, 1926.

COMPARATIVE DIELECTRIC STRENGTH OF VARIOUS MATERIALS

Material	—Dielectric Strength— 25 Deg. C.	100 Deg. C.
Herkolite	100	80
Varnished horn fiber	80	60
Laminated pressboard	54	45
Varnished cambric (flat sheets)	90	74
Varnished cambric (half-lap wraps)	60	48
Porcelain	67	..
Hard rubber	70	..
Glass	57	67

High-Tension Cable Under Oresund Between Sweden and Denmark.—A. R. ANGELO.—Power transmission between Sweden and Denmark was considered in 1912, and a temporary 10,000-volt cable was laid and put in operation in 1915. A new 50,000-volt cable was laid in 1922. The present article gives a description of this cable and the difficulties encountered in its manufacture and installation.—*Meddelelser fra Norske Elektricitetsverkers Forening*, December, 1925.

Units, Measurements and Instruments

Properties and Testing of Magnetic Materials.—T. SPOONER.—This, the tenth article of the series, deals with the effect of heat treatment. It contains a large amount of data and numerous charts on the influence of the rate of cooling from the annealing temperature, 800 deg. C., upon the permeability, residual induction, coercive force, hardness and resistivity of various alloy steels. The influence of certain alloying elements is often profound, as is shown in the author's discussion of the significance of some of the results obtained.—*Electric Journal*, January, 1926.

Parameters of Heating Curves of Electrical Machinery.—VLADIMIR KARAPETOFF.—When a body is being heated by the uniform addition of a constant quantity of heat per unit time, its temperature above the ambient air (as-

sumed constant) rises approximately according to an exponential law. The exponent depends upon the coefficient of thermal dissipation into the surrounding medium. It has been proposed to include such a coefficient among the characteristics of an electrical machine. The present author points out that for thermal purposes a machine cannot be considered as a single body. He established and solves differential equations of heat flow in a combinational body, from which the conclusion is drawn that while an electrical machine could be defined by its thermal coefficients and the temperature rise of the different parts predicted for a given operating régime, a large number of parameters would be required. — *Journal A.I.E.E.*, January, 1926.

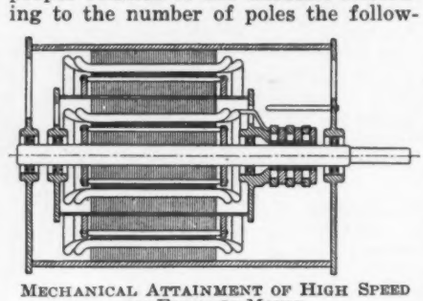
Illumination

Lighting for Production.—PERCY W. COBB.—An analysis of the factors in illumination which affect the speed of production in industrial operations is most conveniently made by laboratory tests in which one element is varied at a time, the results being then checked under factory conditions so far as that is possible. In the present paper the results of a number of such tests are assembled. Thus, it has been found in reading tests with a white background that there is a marked gain in speed with increasing illumination at the lower intensities, which continues at a decreasing rate up to perhaps 40 or 50 foot-candles; with a gray background the same rule holds, but at correspondingly higher intensities. Again, the threshold time for vision is shortened with increased illumination, so that there is a distinct gain with increase of light, but at successively higher speeds equal variation calls for increasing factors as to the change in light required. Another study indicates that the effect of reducing the contrast between object and background has substantially the same effect on the time-brightness curve as reducing the size of the object, with a highly contrasting background. Thus any change which makes the object easier to see also diminishes the time necessary to see it at higher levels of illumination. No universally applicable methods of lighting can be standardized for all industrial situations. Rather, known principles must be applied to insure the best results in any given case, taking into account the conditions to be met.—*Transactions I.E.S.*, January, 1926.

Illumination of Exposition Grounds.—R. BOUTTEVILLE. — An exceptionally brilliant and artistic illumination of the grounds and buildings of the recent decorative arts exhibition in France was accomplished with an expenditure of an average of 18 watts of electrical energy per square meter of area. This required approximately 6,000 kw. for the entire installation. A temporary substation, containing six air-blast transformers and all the necessary central switching arrangement, was erected within the fair grounds and was connected by underground cables to the 12,000-volt, 41½-cycle Parisian supply system. The installed load exceeded 8,200 kw.—*Revue Générale de l'Electricité*, Jan. 2, 1926.

Motors and Control

High-Speed Three-Phase Motor.—B. ULRICH.—There is a demand for three-phase motors of 4,000 r.p.m. to 6,000 r.p.m. for the drive of woodworking machines. Belt drive is not desirable, on account of rapid wear, and the installation of phase changers to provide, for example, 100-cycle current is expensive. A new motor is described which gives up to 6,000 r.p.m. from 50-cycle, three-phase current without differing outwardly from an ordinary induction motor. Within the stator of this new motor revolves a squirrel-cage rotor, which carries again the stator of a second (so to speak) concentric motor, and within it runs the second high-speed rotor. A double set of ball bearings carries these four members in proper relation to one another. According to the number of poles the following speeds may be obtained at 50 cycles: 6,000, 4,500, 4,000, 3,750, etc. The motor can be built with either horizontal or vertical shaft. — *Elektrotechnische Zeitschrift*, Jan. 7, 1926.



MECHANICAL ATTAINMENT OF HIGH SPEED IN ELECTRIC MOTOR

Traction

Passenger Service Electrification on the Staten Island Lines of the Baltimore & Ohio Railroad.—J. H. DAVIS.—This article is an abstract of an address delivered before the New York Railroad Club on Nov. 20, 1925. Abstracts of the material have already been given in the Digest.—*General Electric Review*, February, 1926.

Heat Applications and Material Handling

Heating of Water by Electricity for Domestic Purposes.—S. PARKER-SMITH and N. M. MACELWEE.—In view of the increasing number of British undertakings that offer a low tariff for the night hours, the authors outline the main features of a hot-water storage system and discuss the results of tests from experimental tanks. While the condition for preventing the mixing, so far as possible, of the cold incoming water with the hot water in the tank is found to require a tank at least twice as high as its diameter, it is shown that minimum radiating surface calls for equality of diameter and height, with a given volume. These conflicting demands are in practice best met by cylindrical tanks with h equal to or somewhat greater than $2d$. Oddly enough, the color of a lagged tank seems to make no difference in its heat losses, as was shown by tests with matte white and with dull black surfaces. Apparently the differences in convection and radiation losses balanced. Heat-insulating materials were found to arrange themselves as follows, beginning with the most effective: packed cotton wool, packed brown felt, cork and cement (these three with iron sheath), cork and plaster of paris, magnesia in canvas, loose cotton wool with iron sheath, blue asbestos in canvas, loose brown felt with iron sheath, steatite. The rate of cooling of the last was about twice that of the first. Finally, various matters of fittings are considered, such as the use of non-return valves, the position of the thermometer and thermostatic control.—*World Power*, January, 1926.

Miscellaneous

Power-Factor Problems. — PHILIP KEMP.—Whenever the emf. and current waves are dissimilar in shape, a power factor of unity is impossible, even though the circuit may possess nothing but a non-inductive resistance. One example here cited where this effect is well marked is that of an ordinary incandescent lamp. The resistance varies on either side of an average value, being a maximum when the current is a maximum, with corresponding minima, neglecting a small thermal time lag. On the assumption that the variation is due to a positive temperature coefficient, is sinusoidal and of double the voltage frequency, the current wave form may be deduced mathematically. The author says the influence of this distortion on the power factor is, however, slight; even when the variation of resistance from the mean is as much as 10 per cent, the power factor falls only to 0.998. The effect of the variation on the effective resistance is more marked. Taking again the case of 10 per cent variation from the mean, the effective resistance is 1.047 times the average. Values for other variations are given in a table. Since the amplitude of the variation will vary with the magnitude of the temperature changes during the cycle, it follows that the effective resistance is dependent upon the frequency. A similar analysis can be made in the case of a material having a negative temperature coefficient, which leads to the conclusion that two conductors both having the same steady resistance, but one having a positive and the other a negative coefficient, pass different currents under the same alternating emf.—*Electrician* (*England*), Jan. 1, 1926.

Electrical Engineering in 1925.—In view of the great developments throughout the world, the author restricts himself largely to a consideration of progress in Great Britain. Only a few items can be noted here. One of these is the introduction of an automatic alarm device, to be used in connection with a ship's radio receiving set, which will respond to a predetermined signal from a vessel in distress. Another relates to mercury-arc rectifiers, the ordering of four 900-kw. units for the Paris Metropolitan and the recent installation of a 2,000-kw. substation in London using a group of glass-bulb rectifiers. The review also takes up, among other things, progress on generator sets (with a glance at America), manual and automatic substations, switchgear, traction and mining plants. Mention might be made of the occasional references to specific contracts for British equipment. — *Engineer* (*England*), Jan. 1 and 8, 1926.

News of the Industry

For the Terminable Permit

Indiana Commissioners Testify in Its Favor Before Illinois Investigators—Oklahoma Experience

IN TAKING testimony at Indianapolis in its efforts to obtain light on the working of indeterminate, or terminable, utility permits in those states which have adopted them, the terminable-permit investigation committee from Illinois listened to the views of J. W. McCardle, the chairman, and Clyde H. Jones, a member, of the Indiana Public Service Commission. Indiana adopted a terminable-permit law in 1913.

Mr. McCardle was asked how, under the terminable-permit act, good service was enforced. "Under the old law," he said, "a utility had a right to exist in a community as long as its franchise specified, but now it is a day-to-day matter depending upon good behavior and good service. If the utility's behavior is not good, the commission can permit competition or the municipality may purchase it without waiting for a franchise to expire. I should think the terminable permit would encourage capital to invest in Illinois utilities, and investment of additional capital means just that much more added public service facilities and convenience for the people."

"The people had to get acquainted with its operations before they were satisfied with it," Mr. Jones said. "I think that now they are satisfied, for the reason that agitation since then to abolish both the commission and the terminable permit, and everything else, has not got to first base. The people, as a whole, are pretty well committed to the idea that the terminable permit is a good thing."

The Oklahoma Utilities Association reports that since the revocable permit law went into effect in that state in May, 1925, citizens of at least 43 cities and towns have voted franchises to public utility companies for electric light or gas service. Greater activity in extending utility service and voting utility franchises has been manifested during these nine months than during any previous similar period in the history of Oklahoma.

New York Savings Banks Seek Leave to Buy Utility Bonds

By means of an amendment to the savings bank investment law of New York introduced into the Legislature by Assemblyman Willis H. Sargent of Syracuse, with the indorsement of the Savings Bank Association of New York State, the words "railroad bonds" in this law would be changed to "bonds of railroads and other corporations," in order to permit savings banks to invest in the bonds of electric light and power or gas companies incorporated under federal or state laws, provided that such investments conform with conditions laid down. These conditions are stated in a new section of the law. They provide that at least 75 per cent of the gross operating revenues of any corporation whose bonds are purchased shall be derived from supplying electrical energy or gas and not more than 15 per cent from any one kind of business other than this, as well as that the company whose bonds are purchased shall be subject to regulation by a public service commission established under the laws of the nation or the state in which the company operates. Eight supplementary requirements relating to the financial set-up and performance and the franchise possessions of the company in which investment is sought follow.

Although the bill, if passed, will take effect immediately, a requirement that the superintendent of banks shall furnish to savings banks a list of such authorized investments "on or before the first day of January in each and every year" would apparently postpone its operation until 1927.

Conowingo License Signed

Secretary Merrill for Federal Power Commission Approves Great Susquehanna Project

A PERMANENT license for the construction of the huge hydro-electric plant at Conowingo, Md., on the Susquehanna River, and its appurtenances was signed by Executive Secretary Merrill for the Federal Power Commission on Saturday, Feb. 20. This action followed a conference at Washington on the previous day between representatives of the Federal, Pennsylvania and Maryland commissions with regard to the financing plans. A report on these plans will be prepared by Mr. Merrill, and the applicants will have another opportunity to be heard if they so desire. The financial plans must be approved by the Federal and Maryland commissions, the Pennsylvania body being without jurisdiction over the issue of securities. A conference between Mr. Merrill and Ezra B. Whitman of the Maryland commission was held on Wednesday.

Hits at Federal Injunctions in Rate Cases

Governor Moore of New Jersey Asserts that They Tend to Nullify State Commission Control and Favors National Law to Restrict Them

NATIONAL legislation to force utility companies seeking relief from commission rate orders alleged to be confiscatory to exhaust the resources of state courts before applying for injunctive relief to United States judges was favored by Governor A. Harry Moore of New Jersey in a special message sent to the Legislature of that state on Monday of this week.

"The practice of public utility companies in rate cases of applying to the federal statutory court for injunctive relief has been carried on to such an extent in recent years as to practically oust the state of its jurisdiction in the regulation of rates of such companies," said the Governor. "While the Board of Public Utility Commissioners of this state has many other functions, it is apparent that the determination of fair and reasonable rates affects more directly the citizens of the state and the companies doing business within this state. The utility corporations of this state are conducting a business which by its very nature is vested with public interest. The business is purely intrastate and affects only the citizens of the state. The problem of regulation of the service and rate of such companies should therefore be solely within the state's jurisdiction.

"I believe it is an undue interference of the federal statutory court to intervene in the matter of regulation of rates of the companies of the state. This is now done by immediate application for injunction to the federal courts, the effect of which is to suspend immediately the rates of such companies as determined by the board upon a hearing after notice, and aft r full consideration of all matters necessarily and properly considered in rate cases, and thereby make futile the effort on the part of the state to regulate the rates of utility companies.

"In a recent case from New Jersey determined by the federal statutory court one of the judges thereof indicated that the federal statutory court should not take jurisdiction where full and ample judicial review was provided by the state in appeal from decisions of the state utility commission. This leaves the problem clearly discretionary, whereas it should be mandatory by proper legislation which will define the jurisdiction of the federal courts in matters of this nature."

Several bills of the kind advocated by Governor Moore have been int o-duced into the sitting Congress. As reported by the Washington correspondent of the ELECTRICAL WORLD last week, the judiciary committee of the House of Representatives shows no disposition to report any of them.

In his inaugural message last month Governor Moore attacked state regulation, saying: "The policy of regulation has completely failed to secure reasonable rates to our people for public utility service, such as transportation, telephone and electric light rates."

Commercial Topics on Coast

Northwest Association Discusses Rates, Refrigerators, Rural Service, Lighting and Ranges

CHARACTERIZED as a "high-powered" meeting, crammed full of facts ready to be carried home for future use, the first general meeting of the Commercial Section of the Northwest Electric Light and Power Association was held at the Davenport Hotel, Spokane, Wash., on Feb. 18 and 19. During two full days sixty or more power-company commercial men and visitors exchanged experiences, told of successful sales methods, disclosed profits yielded by activities in different lines, debated pros and cons of certain practices leading to the crystallization of opinion as to policies, and otherwise educated one another. Interest was nearly equal in the range, the domestic refrigerator, commercial lighting, rural electrification and residential rates. Lewis A. Lewis, sales manager Washington Water Power Company and president of the association, said that in the past commercial departments of the power companies had not been on a par with such departments in other industries, but that executive sentiment was changing this situation.

Two definite proposals bearing on advertising policy and promotion methods for electric refrigerators were adopted. The first, addressed to the manufacturers, proposed that they cooperate with the central-station companies in eliminating the manufacturer's profit on such machines as could be placed in the homes of power-company employees. The second resolution was addressed to the executive committee of the Northwest association and recommended that the executive committee urge its member companies so to conduct their advertising and selling activities as not to antagonize the commercial ice manufacturers.

Discussion went deeply into many phases of obtaining and handling range business, all of the member companies reporting on their practices. Some of the companies have recently raised their prices to list to allow the furniture stores, department stores and other dealers to "get into the game." Disagreement with this policy arose in some quarters, mainly on the ground that it introduced difficulties in servicing.

Much interest was displayed in the water-heater discussion, all companies agreeing that they were not getting sufficient revenue from this business, which in the Northwest is carried on mostly by low-wattage flat-rate heaters.

Two recent campaigns on commercial lighting, the first intensive effort in this activity in the Northwest, were reported, one by the Pacific Power & Light Company and one by the Washington Water Power Company. Startling results in the way of increased revenue were obtained at a remarkably small cost.

Power sales activities in the industrial heating field, it was brought out, depend on population and industry and offer a fairly large opportunity in some parts of the territory. Enameling plants and glass-annealing plants are two of the principal classes of "prospects,' both involving highly technical processes. Specially trained heating engineers are required by the power companies contemplating entry into this field.

L. A. McArthur, vice-president and general manager Pacific Power & Light Company, Portland, who heads the association's rural electrification committee and is a member of the national committee on this subject, told of the work of the national committee, stating that some difference of opinion exists as to the theory of the rate to charge for rural service. In some sections of the country the policy is to make the rate carry the extra investment charges, while in the Northwest both central-station companies and regulatory bodies favor a rate little higher than urban rates, with an advance payment of revenue to absorb the carrying charges on the unproductive portion of the investment.

E. C. Johnson, dean of the College of Agriculture, Washington State College, Pullman, said that both Oregon and Washington have active committees that have made surveys of the situation in their respective states and are continuing studies of specific subjects suggested by these surveys. Fifteen per cent of Oregon farms are electrified, but it would cost $20,000,000 to build distribution lines to reach all of the farms of the state.

W. R. Putnam, vice-president and general manager Idaho Power Company, Boise, said that in certain localities economic influences prevented the transfer to city customers of any considerable portion of the cost of furnishing rural service. Some companies have no large concentrations of urban business on which to saddle such burden.

An informal discussion of residential lighting rates brought out a variety of opinions as to the merits and demerits of block rates, room rates, demand rates, load-factor rates and rates based on cost of service, on value of service and on what the traffic will bear.

St. Lawrence-Niagara Agreement Sought

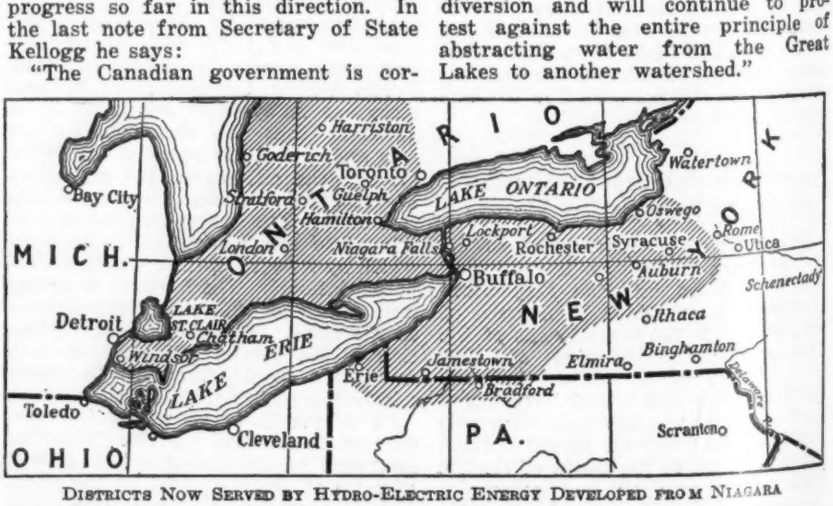
Diplomatic Correspondence with Canada Indicates Likelihood of Negotiating Treaty Covering Great Lakes Diversion, More Power from Falls and Scenery Preservation

DIPLOMATIC correspondence between the United States and Canada in connection with the protest made by the Dominion against diversion by Chicago of Lake Michigan water has just been made public by the State Department at Washington. These negotiations have an important bearing on St. Lawrence River development and the matter of appropriating a larger proportion of the flow at Niagara for the production of hydro-electric energy. The United States has consented to include the question of the Chicago diversion in the consideration of the engineering problems of the St. Lawrence seaway, and the administration now views with favor the negotiation of an agreement with Canada covering the entire group of related questions pertaining to joint use of the Great Lakes and the St. Lawrence River by the two countries.

The correspondence published does not, however, indicate any marked progress so far in this direction. In the last note from Secretary of State Kellogg he says:

"The Canadian government is correct in concluding that no immediate reduction in diversions has been provided, but its conclusion that no definite reduction is assured and that the effect of the permits will actually be to authorize a greater diversion than is now being made cannot be confirmed. The gross flow at Lockport will not exceed an average of 9,700 cu.ft. per second, and by the time the permit of March 3, 1925, has expired, the gross flow may be reduced to 8,000 cu.ft. per second and probably to 6,700 cu.ft. per second. The sewage treatment program of the Sanitary District has been arranged so as to make it possible to effect a reduction to a gross flow of 4,167 cu.ft. per second by the year 1935 or before."

In tabling in the Ottawa Parliament the correspondence of which this was the conclusion the Canadian Minister of the Interior said that the Canadian government "has never at any time recognized in the smallest degree the diversion and will continue to protest against the entire principle of abstracting water from the Great Lakes to another watershed."



DISTRICTS NOW SERVED BY HYDRO-ELECTRIC ENERGY DEVELOPED FROM NIAGARA

The contemplated international pact would embrace (1) the construction of the St. Lawrence seaway, enabling ocean ships to penetrate to all of the Great Lakes and development of the incidental water power by the United States and Canada, as a joint undertaking, at a cost now estimated at $275,000,000; (2) an accord on the conservation of lake levels, involving an authoritative ascertainment of the climatic influences, a revision of the treaty authorizing Canada to divert 36,000 sec.-ft. and the United States 20,000 sec.-ft. at Niagara Falls, an agreed restriction of the diversion at Chicago and the Welland Canal, and compensating plans in the St. Clair and the Niagara Rivers to offset lake withdrawals, and (3) preservation of the scenic beauty of Niagara Falls by the construction of concrete islands in the Niagara River so as to retard, by deflection of the current, the gradual destruction of the Falls by erosion.

Since the question of diverting more water for power purposes would give rise to controversy, the American government hopes the question of recession at the Falls can be considered without reference to power questions. The Canadian authorities seem of the opinion that the two questions are inseparable. The need for action at the earliest possible moment to protect the Falls is recognized in the Dominion as it is here. The need for more power is probably greater on the American side, but Canada does not have to reckon with numerous organizations that will see in any further diversion at Niagara Falls a step likely to mar their scenic beauty.

American Capital May Back Superpower in Europe

A plan to raise capital in the United States to create a superpower electrical system in central Europe was revealed last Saturday by the sailing from New York for his transatlantic home of Dannie Heineman, president-director of the Société Financière de Transport et d'Enterprises Industrielles of Brussels, Belgium. He had arrived in America two weeks previously to negotiate for funds to build such a system, and it was given out that a tentative agreement had been reached with the backers of the American-European Utilities Corporation to supply $10,000,000. Negotiations, however, are incomplete. An eleven-million-dollar generating plant in Budapest and a superpower system in eastern Poland are among the ideas included.

East Central Commercial Men Delve Into Rates

Rate structures and their influence in promoting new business for the central-station company were intensively discussed at a general meeting of the Commercial Section of the East Central Geographic Division, N. E. L. A., at Cincinnati on Wednesday, Feb. 24.

C. S. Reed in a paper on rates urged the adoption of a three-part rate, with the "come-along" feature to encourage use of energy, instead of the straight-line rates now in effect, which tend to limit consumption. M. P. Walsh, section chairman, pointed out that utilities must increase the utilization of their investment and that this responsibility rests with central-station commercial men. In this connection H. W. Derry described the industrial lighting campaign, stating that this activity had resulted in the addition of 17,000 kw. of industrial lighting load to the lines of the Union Gas & Electric Company in Cincinnati. J. F. Horgan, chairman of the power committee, urged members to collect and interchange specific data on industrial electric heating installations and pointed out that this business represents the largest undeveloped field for additional new load.

St. Lawrence Permits Deferred

New York Water Power Commission Will Await Adjustment of Legal Situation with Federal Power Board—Hugh L. Cooper Pleads for Development

LEGAL obstacles have arisen from a conflict of authority between federal and state laws which will delay the issuance of permits by the New York State Water Power Commission for development of Niagara or St. Lawrence power until an agreement can be reached with the federal authorities. Both leases granted by New York State and leases granted by the Federal Power Commission contain a recapture provision, and it is entirely clear that both the federal government and the state cannot recapture the same property. Charles Evans Hughes, retained as a special deputy attorney-general to bring about an understanding with the federal authorities, has asked for further time to complete his efforts. The attack of Governor Smith on the intended action of the board and the newspaper and popular support which the executive succeeded in attracting were doubtless also instrumental in causing the commission to postpone action.

The hearing by the New York State Water Power Commission on Thursday morning was held to receive the answer of the Lower Niagara River Power & Water Supply Company to the offer of a preliminary permit made to it by the commission last fall and to take testimony in relation to the applications of the Louisville Power Corporation to develop Croil Island power possibilities in the St. Lawrence and of the St. Lawrence Valley Power Corporation to make a similar development at Long Sault Rapids.

In order to clarify the situation as to who are behind these projects for development of water in the St. Lawrence River a statement was issued by George T. Bishop, president of the Frontier Corporation, the holding company of the Louisville Power Corporation and St. Lawrence Valley Power Corporation, in which it was declared that the stock of the Frontier Corporation is owned by the Aluminum Company of America, Du Pont de Nemours & Company and the General Electric Company.

The first public submission of figures on the estimated cost of development of the 3,100,000 hp. undeveloped in New York State was made by Colonel Hugh L. Cooper, who was in charge of the Muscle Shoals development. Colonel Cooper declared that to generate the power and distribute it to the boundaries of municipalities would entail a cost of $665,000,000 under private development under the most economical conditions, but if such development were to be made by the use of public funds the cost, judging by past experience, would be double that amount.

Colonel Cooper made a plea to the commission that the State of New York, to continue its commercial supremacy, should endeavor to bring about an arrangement with the federal authorities by which its natural resources could be speedily developed. He said the state had lost during the past year new business enterprises which could have utilized half a million horsepower which has gone to other states and that New England is rapidly losing many of its industries because of the lack of power. Colonel Cooper contended that for each dollar invested in power development $9 worth of outside industry could be attracted to the Empire State, which would mean an ultimate addition to its industrial assets of more than $6,000,000,000.

REPUBLICANS ISSUE STATEMENT

A statement outlining the policy of the Republican legislative majority at Albany on various matters was issued after a party conference this week. It is possible that it may be modified when the report of the commission on reorganization of the state government which has been working under the chairmanship of Charles E. Hughes is received. On water power the Republican statement says:

"We oppose the sale of the people's interests in the water-power resources of the state. Like the forests of the state, these powers never should be alienated. We approve the policy laid down in the present statute in 1921 which authorized the authorities of the state to lease its surplus canal waters and its other water-power resources for a limited period of time, retaining in the state the right to readjust the terms of the lease at stated periods, the right of recapture and the full authority to fix rates to consumers and to regulate service.

"There can be no exploitation of the state's resources by private companies under this law. It is economically sound and insures the people of the state speedy development and reasonable rates for service. We oppose government operation, which inevitably would bring political control with its resultant waste, loss and gross extravagance."

The statement also opposes the proposal to give municipalities complete control over utility corporations within their limits and supports commission regulation as at present established in the state.

Purchases and Mergers

No Outstanding Transfer Reported, but Small Plants in Every Section Continue to Be Sold

ARTICLES of incorporation are being prepared for the formation of the People's Light & Power Corporation, with a capital stock of $10,000,000, to acquire and operate electric utility properties in the United States and Canada. The control and management will be in the hands of the W. B. Foshay Company. Recent additions to the Foshay group of electric utility properties are the Ilwaco Light & Power Company of Ilwaco and the Willapa Power Company at South Bend, both in the State of Washington; the Henderson Light & Power Company of Henderson, Minn., and the hydro-electric properties at Mason, Wis. Transmission lines are now under construction from Mason to Grandview, Drummond and Cable, Wis.

The Empire Power Corporation, recently incorporated in New York, will, as already noted, control the United Gas & Electric Corporation, among the subsidiaries of which are the Elmira (N. Y.) Water, Light & Railroad Company, the Lockport (N. Y.) Light, Heat & Power Company, the Richmond (Ind.) Light, Heat & Power Company and the Union Gas & Electric Company of Bloomington, Ill. The Empire Power Corporation will also control the New York Central Electric Corporation, serving an important territory with headquarters at Perry, N. Y., and the Empire Gas & Electric Company of Geneva, N. Y. The United Gas & Electric Corporation owns stock in the Lehigh Power Securities Corporation, which recently took over utility properties at Harrisburg, Lancaster and other Pennsylvania localities, and in the Long Island Lighting Company.

Application has been made to the New York Public Service Commission by the Adams Basin Electric Light & Power Company, Inc., of Adams Basin, for authority to transfer its franchises, works and system to the Rochester Gas & Electric Corporation. The Adams Basin Company supplies electricity in the towns of Ogden, Parma and Sweden, Monroe County. The New York commission has authorized the village of South Glens Falls to sell its street-lighting system to the Adirondack Power & Light Corporation.

The Shenandoah River Power Corporation has purchased for $25,000 the lines and rights of the North River Electric Company, which has supplied Bridgewater, Va., and will link that town with its transmission system: With the exception of the municipal plants of Harrisonburg and Shenandoah, the Shenandoah River Power Corporation now controls all the generating plants in the mid-valley and supplies virtually every community in this district of Virginia from its hydro-electric stations at Rockland Mill, Grottoes and Woodstock.

W. C. Sparks, vice-president of the Rockford (Ill.) City Traction Company, has sold to Stuart Ralston his interest in the Roscoe (Ill.) Electric Company, which he and Ralston organized in 1920. The utility supplies energy to nine small communities.

The Southern Cities Power Company of Chattanooga, which has been acquiring small properties in Tennessee, has asked the commission of that state to sanction its purchase of the Bell Buckle Light & Power Company for $30,000.

Prize Contest of Industrial Lighting Activity

In making suggestions as to the submission of reports on the nation-wide industrial lighting activity of the National Electric Light Association for the three prizes of $2,500, $1,500 and $1,000 to be awarded in the spring, as reported in the ELECTRICAL WORLD for Dec. 12 (page 1223), the judges specify as points on which the awards will be based (values ranging from five to twenty each in a total of 100) the number and percentage of factories or industrial establishments in community or district to which better lighting equipment has been sold, the number and percentage of additional factories which have been "sold" on the idea of better lighting, the quantity and value of material sold on contracts for better lighting from the beginning of this campaign to March 1, the extent and spirit of co-operation among electrical interests in community or district, the extent and character of local publicity, the extent and character of follow-up work on local publicity, the indorsements of civic and business groups obtained in community or district, the completeness of statistics in installation reports, the evidences of other business influenced, i.e., the effects on sign lighting, floodlighting, office lighting, etc., and the clarity and completeness of the general report.

These specifications are embraced in a "judging sheet" issued by the committee. In this sheet some of the items are subdivided to indicate in detail the information desired, and the respective values of the ten groups of data are attached. Encouraging progress in the campaign is announced.

Minneapolis Firm Has Extensive Canadian Program

The Backus & Brooks Company of Minneapolis has just completed arrangements for a further step in a ten-million-dollar development program across the Canadian border by awarding a contract for the construction of a 110,000-volt transmission line, 110 miles long, from the Seine River in northwest Ontario to Fort Frances, Ontario, on the Rainy River. The line, besides furnishing energy to towns, will supply power for a large paper mill of the Fort Frances Pulp & Paper Company controlled by the Backus-Brooks interests. The transmission line will cost more than $750,000, the contract for erection of the poles and wires involving about $250,000. It will connect the paper mill at Fort Frances with a power plant which it is understood the Backus-Brooks interests will build this year on the Seine River, about 100 miles east of the point where it empties into the Rainy River. The entire output of energy, approximating 32,000 kw., will be transmitted over the new line.

Other Canadian developments of the Backus-Brooks company include a power plant on the Winnipeg River, producing 17,000 hp.; expansion of the manufacturing plant at Kenora, Ontario, and improvements at its other operating points at Fort Frances and International Falls.

In connection with the Minneapolis firm's undertakings on the Seine River a report from Ottawa to the ELECTRICAL WORLD has interest. This is to the effect that industrial interests in Port Arthur and Fort William, Ontario, are considering a suggestion that the Hydro-Electric Power Commission of Ontario be requested to develop this river, which is about 150 miles west of the cities named and is said to have a potential capacity of 60,000 hp. The district is rich in timber and iron ore.

Muscle Shoals Not Yet on Senate Floor

House Resolution Likely to Be Adopted, Perhaps with Amendments Providing for More than One Lease and for Distribution of Surplus Power

BY PAUL WOOTON
Washington Correspondent of the ELECTRICAL WORLD

DELAY in disposing of the Aluminum Company controversy made it impossible for the Senate leaders to bring up the Muscle Shoals resolution the first of the week in accordance with their legislative program. As this is written prospects seem to favor the passage of the House resolution, but a determined effort will be made to amend it. The principal amendment sought is to provide for more than one lease and for the distribution of such power as may not be needed for fertilizer production. There is a growing sentiment in the upper chamber against disposing of the birthright until a better measure of its value shall have been obtained.

The friends of the House resolution are emphasizing their contention that it is futile to discuss objections at this time, since they can be brought up when the joint congressional committee reports its conclusions to Congress, but the opponents of the resolution scent danger in this plan. The prospects are that the date for the report of the joint committee will have to be postponed. This probably will result in the findings being laid before Congress in the closing days of the session. It then would be impossible to take enough time from other legislation to insure calm consideration of the matter, and if an unsatisfactory proposal were submitted, there would be little opportunity to demonstrate the objections to it. The opponents of the resolution, however, feel that at least the filibuster weapon could be wielded to advantage.

Montreal Engineering Company Gets Chute des Chats

The rights on the Chute des Chats waterfalls on the Quebec side of the Ottawa River, about 40 miles north of Ottawa, have been leased by the Quebec government to the Montreal Engineering Company, at a yearly rental of $14,800. The city of Ottawa and the Acme Company were also bidders for the site and no less than 102 separate offers were made by those interested. The Montreal Engineering Company, which is already the holder of rights in that vicinity, intends using the newly acquired power for the further development of the property of the Kingdom Mining Company. All the available power at the falls, estimated at 150,000 hp., will be developed, construction of the first units to begin in the near future. Had the city of Ottawa been successful in the bidding, the power site would have been transferred to the Ontario Hydro-Electric Power Commission as part of the plan for the joint power development of the Ottawa River by Ontario and Quebec.

Ontario Hydro May Expropriate Chute des Chats

In outlining the Ontario government's policy with regard to the development of the Ottawa River for power purposes, Premier Ferguson, speaking in the Ontario Legislature on Feb. 17, announced that he had the assurance of the Province of Quebec that nothing would be done to injure Ontario's rights on that river. The Premier's statement was made in answer to the question whether or not the sale by Quebec of its power interests at Chute des Chats falls near Ottawa to a private enterprise, the Montreal Engineering Company, affected Ontario's rights, or whether it would interfere with the proposal for joint development of the various power sites on the Ottawa. The Premier intimated that the Ontario government was anxious to acquire the Chute des Chats site and that the Hydro-Electric Power Commission of the province was trying to expropriate it.

Another interesting statement made by the Premier was that certain private enterprises in Quebec holding power rights were favorable toward joining Ontario in development schemes. He emphasized the Ontario government's anxiety to see development carried out as the power needs of eastern Ontario constitute a serious problem.

Prof. W. Z. Ripley Makes a Rejoinder to Critics

In a statement made by him last Saturday Prof. William Z. Ripley of Harvard University showed resentment at some of the replies called forth by his widely published views on financial practices indulged in by certain industrial and utility companies, declaring that ridicule of him as an "uplifter" or utterer of "sob stuff" had no foundation. He pointed out that in his address before the Academy of Political Science and in his *Atlantic Monthly* article he confined himself for the most part to the non-voting-stock issue and the common shareholders' right to representation and that public utilities were only incidentally touched upon.

"Through no fault of mine," Dr. Ripley added, "some men in the public utility field are forcing the issue of supervision by the nature of their criticism of my statements. By their hostility to criticism they are only calling attention to abuses in public utility finance. The financing of some public utility corporations is extremely unwise and liable to grave abuses. The brakes should be applied at once. These will be applied either through a more healthy morale within or from Washington."

Although he did not condemn the holding corporations as such, Dr. Ripley called attention to some abuses to which he thought them liable in the public utility field. It is common, he said, for a public utility company to display to the public a clean slate when its subsidiary operating companies may be mortgaged to the hilt. "Many of these public utility holding companies," Professor Ripley continued, "are not listed on the New York Stock Exchange because they do not wish to make public the details of their organizations which listing with the Exchange would require."

Professor Ripley spoke of customer ownership as "sound within reasonable limits, but fraught with dangerous possibilities, which may degenerate into practical bribery of the participating consumer to acquiesce in a scale of rates unjust to the non-investing consumer.

Shawinigan 1925 Output Over 2,000,000,000 Kw.-Hr.

Aside from revealing gross earnings of the Shawinigan Water & Power Company for 1925 at the highest level in the history of the enterprise—$6,702,034, as against $5,741,097 in 1925—the statement presented by President Aldred at the annual meeting in Montreal on Feb. 16 gave some facts regarding the company's progress. The principal projects carried out were the construction of a new substation in Montreal to permit the delivery to the Montreal Light, Heat & Power Consolidated of a large additional amount of power and improvements and extensions to the transmission lines and distributing facilities for the large industries in Three Rivers, necessitated by increase in loads aggregating about 25,000 hp. The North Shore Power Company has been constructing a power development on the Batiscan River at St. Narcisse which before the end of this year will be connected with the company's system at Three Rivers.

The following reference is made to the company's output of power for the year: "In speaking of the output of electricity and water power sold by the Shawinigan company, it is well to understand that included in this output is power generated at the two plants at Shawinigan Falls, power purchased from the Laurentide Power Company and from the St. Maurice Power Company, Ltd. The total gross output in kilowatt-hours of the Shawinigan company for the year was 1,529,339,180. The peak load for the year was 340,000 hp. This amount did not include the secondary power nor the water power sold at Shawinigan Falls, approximately 55,700 hp. The total secondary power output for the year was 473,845,930 kw.-hr."

Oklahoma Association Has Good Program for Tulsa

The eighth annual convention of the Oklahoma Utilities Association, to be held at the Mayo Hotel, Tulsa, on March 9, 10 and 11, will bring together not only representatives of all branches of the public utility industry of Oklahoma but also representatives of the manufacturers and suppliers. The entire fifteenth floor of the hotel will be reserved for exhibitors. Wednesday, March 10, will be observed as the fiftieth anniversary of the first telephone conversation. F. B. MacKinnon of Chicago, president of the United States Independent Telephone Association, will be one of the speakers. Another feature of the convention will be an address by E. P. Dillon of New York, general manager of the Research Corporation, who will discuss the purposes and work of his organization.

Thomas F. Kennedy of New York, a member of the executive committee of Henry L. Doherty & Company; J. E. Davidson of Omaha, Neb., president N. E. L. A.; General Charles Keller of Chicago, head of water-power development for the Byllesby Engineering & Management Corporation and former member of the Utilities Commission of the District of Columbia; E. H. Sniffin, manager of the power department of the Westinghouse company, and other men of national prominence in the public utility industry are expected to take part in the general and electric sessions.

Rhode Island Lighting Institute Announces Plans

Active steps toward the more effective development of modern illumination in southern New England are embodied in the plans of the Rhode Island Lighting Institute, which was scheduled for dedication Feb. 25 at Providence, under the auspices of Brown University, the Rhode Island Chapter of the Illuminating Engineering Society, the Providence Engineering Society, the Rhode Island Electrical League, the Narragansett Electric Lighting and Blackstone Valley Gas & Electric companies and others. At Brown University a permanent "classroom" devoted to the demonstration and promotion of better industrial and commercial lighting has been established.

The 1926 lighting school under the auspices of the New England Division, N.E.L.A., will be held at the Institute March 1-4, inclusive. The leading speakers will be C. J. Campbell and Samuel Hibben, Westinghouse Lamp Works; J. Daniels, Edison Electric Illuminating Company, Boston; Merritt Horner, Jr., and W. H. Rademacher, Edison Lamp Works; H. T. Spaulding, National Lamp Works, and P. J. Wilson, Lowell Electric Light Corporation.

A Budget of $28,000,000

This Sum Estimated by Detroit Edison Company as Amount to Be Spent in 1926

CONSTRUCTION for 1926 as preliminarily budgeted by the Detroit Edison Company approximates $28,000,000, the largest sum in the history of the company, comparing with $20,600,000 last year and $27,300,000 in 1924.

At Trenton Channel the substructure for the second section of the power house is well under way, and during 1926 it is proposed to complete the structure and, as already reported, to add two 50,000-kw. turbines, Nos. 4 and 5, and three more boilers. This plant has proved highly economical in operation, consuming a third less coal for the same output than the old Delray plant. It is also planned to add one 30,000-kw. turbine and three new boilers at Marysville, giving that plant a total rated capacity of 80,000 kw. All this will necessitate an expenditure of somewhat more than $10,000,000, mostly in the present year, for it is planned to have two of these three turbines in operation before the end of 1926.

The program for substations constitutes a very large part of the construction budget, and this work will call for the expenditure of more than $7,000,000. A new alternating-current outdoor substation will be built at McKinstry Avenue, just north of Fort Street West, to cost $525,000, and the connecting transmission and distribution lines will bring the amount up to $1,200,000. A 120,000-volt stepdown station at the northeast corner of the city, on Mount Elliott Avenue and Eight Mile Road, will cost $800,000, including the site. From this high-tension station 24,000-volt cables laid in conduits will radiate to feed adjacent substations, and these conduits and cables will cost $1,200,000 more. A 120,000-volt steel-tower transmission line will run from the station northerly to the vicinity of Yates, where it will connect with the present 120,000-volt line running between Marysville and Bloomfield. The switching station near Yates will cost $325,000 and the transmission line from the Northeast station to Yates will cost $200,000.

OTHER EXPENDITURES

It is planned to add extensively to the capacity of the existing 120,000-volt stations, preliminary plans calling for 75,000-kva. in new transformers for Bloomfield, Brownstown, Navarre and West Warren, which will cost $350,000, and to build seven 4,800-volt automatic reclosing substations in the city and in the suburban territory, which will call for the expenditure of about $700,000. Late in the year the Farmer Street heating plant will probably be rebuilt as a direct-current substation at a cost of $500,000.

Miscellaneous additions, betterments and changes in existing equipment bring the expenditures on substation construction to the total mentioned above. Besides all this, nearly a million dollars will be expended on existing overhead transmission and distribution systems, and perhaps more than $3,000,000 on extensions for expected new business. Central-heating outlay and the purchase of future sites account for the rest of the budget.

Briefer News

Virginia Public Service Corporation Organized. — Supplemental articles of association of the Virginia Central Power & Light Company of Richmond, changing its name to Virginia Public Service Corporation, have been authorized by the Virginia State Corporation Commission. This company is one of the A. E. Fitkin Southeastern properties.

Iron and Steel Engineers to Hold Safety Congress in March.—A safety congress under the auspices of the Safety Division of the Association of Iron and Steel Electrical Engineers will be held on Wednesday, March 10, at the William Penn Hotel, Pittsburgh, on the subject of the safe operation of electric overhead traveling cranes. There will be both morning and afternoon sessions.

Utility Company Takes Over Load of Broken-Down Municipal Plant.—The Southwestern Light & Power Company at Duncan, Okla., started to carry the electric load of the city of Duncan in January and is still handling it. On Jan. 1 the Duncan municipal electric plant broke down and the city requested the company to supply power not only for its customers but also for pumping water and furnishing street lights. This is the second time within two years that the Duncan municipal plant has broken down and the Southwestern Light & Power Company has stepped into the breach.

Kentucky State Committee of Women Formed.—A Kentucky state committee of women engaged in public utility work has been organized at Louisville. The committee plans to hold annual meetings, which will be scheduled at the same time as the meetings of the Kentucky Association of Public Utilities. Miss Helen F. Gordon of the Louisville Gas & Electric Company was named secretary.

Calgary Municipal Plant May Absorb Private Competitor.—A situation has arisen in Calgary, Alberta, which may culminate in the city taking over the Calgary Water Power Company. The city, which has a municipal light and power plant, has published a notice that it will apply to the Legislature for power to purchase the plant of any public utility company distributing electrical energy within the limits of the city. As there is but one such company, the Calgary Water Power Company, which has been in existence from the very early days of the city, the suggestion has aroused widespread interest in the Canadian province.

Applying Automatic Synchronizing to Large Units.—Automatic synchronizing devices contemplated in the design of the electrical equipment for the Baker River plant of the Puget Sound Power & Light Company, Seattle, but not installed at the time the plant commenced operating in November, 1925, have just been put into service. The size of the units to which they have been attached —19,500 kva.—and the fact that these units comprise a large percentage of the total generating capacity of the system make the installation one of unusual interest. The devices are reported to be operating satisfactorily, and considerable time in synchronizing is being saved.

Samuel Insull Again Advocates Carrying Electricity to Hamlets and Farms.—Before the Cleveland Chamber of Commerce last week Samuel Insull, president of the Commonwealth Edison Company, Chicago, drew a vivid picture of the important part which public utility companies play in community and industrial growth. Mr. Insull took as his subject "Factors That Tend to Produce Municipal Development." He declared that interconnection of systems is bringing to the smaller cities and towns the benefits formerly enjoyed only in the metropolitan areas. Extensions of lines into the hamlets and rural districts he held to be vitally important to the growth and health of the nation in making living conditions more attractive and convenient outside of the densely populated centers. In

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 9-11. E. F. McKay, Local Bldg., Oklahoma City.

Illinois State Electric Association—St. Nicholas Hotel, Springfield, March 17-18. R. V. Prather, 205 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Electrical Inspectors' Association—Madison, March 17-18. A. C. Schultz, Underwriters' Exchange Bldg., Milwaukee.

American Institute of Electrical Engineers—Regional meetings: Cleveland, March 18-19; Madison, Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division (and Iowa Section), N. E. L. A.—Fort Des Moines Hotel, Des Moines, April 8-10. H. M. Davis, Fraternity Bldg., Lincoln, Neb.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

Southeastern Division, N. E. L. A.—Pinehurst, N. C., April 27-29. C. M. Killian, 317 Hurt Bldg., Atlanta.

Nebraska Section, N. E. L. A.—Lincoln, April 29-30. H. M. Davis, Fraternity Bldg., Lincoln.

Missouri Association of Public Utilities—Springfield, Mo., May 2-4. F. D. Beardslee, 315 North 12th St., St. Louis.

Electrical Manufacturers' Club—Hot Springs, Va., May 12-15. W. F. Field, Safety Cable Co., New York.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

this connection Mr. Insull made a plea for better transportation facilities. "The day is not far distant," he said, "when the whole country will be one great web of power lines. It will be then that the farmer's wife may find life more endurable in the country and farm chores will be lessened to a minimum."

Tacoma's New Municipal Plant to Start Soon.—The city of Tacoma, Wash., is making elaborate plans for the celebration of the opening of its power plant on Lake Cushman, which is planned for the first week in March. Representatives of eight civic and service organizations in Tacoma have charge of the plans, in which citizens will be urged to participate. President Coolidge will press a button in the White House illuminating electric signs on the two large towers at the Narrows which form part of the installation.

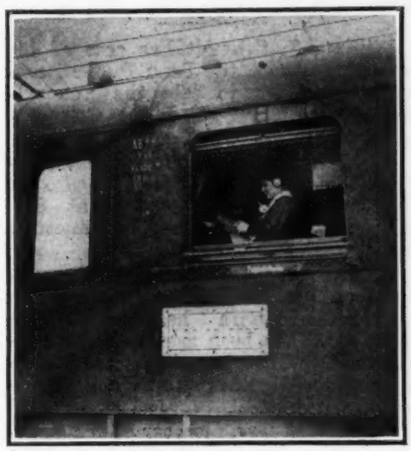
East Texas Company to Spend Million and a Quarter.—The East Texas Public Service Company plans to spend approximately $1,250,000 in improvement and expansion of its properties during the current year, according to Knox Lee of Marshall, general manager of the company, whose transmission system extends to 37 towns. The program includes the construction of 125 miles of high-voltage transmission lines and increasing the voltage of the line from Marshall to Grand Saline from 33,000 to 60,000. This line will be connected with the Texas Power & Light Company's system in order to insure regular service at all times. A new turbo-generator with auxiliary equipment has just been installed at Marshall. Additional power will also be available from the 60,000-volt line west of Mineola.

Holyoke Municipal and Private Plants in Harmony. — The Holyoke (Mass.) Gas and Electric Light Commission, in explanation of the power bill desired by the Holyoke Power & Electric Company, says it will give the power company no new Holyoke rights, but will confer upon it unrestricted power rights outside of Holyoke and will give it permission to sell energy to a railroad or street railway corporation or to the city of Holyoke. The local commission says that the bill fully protects the municipal plant, while at the same time giving the Holyoke Power & Electric Company and the Holyoke Water Power Company an opportunity to go ahead in their expressed desires for further development of the power resources in the territory.

Central New York Cities Differ Over Changes in Frequency.—Troy, Albany and Cohoes, the only cities in central New York State using 40-cycle energy, have been considering changing over to 60-cycle frequency, and it is announced by H. C. Shields, general manager of the Troy Gas Company, which has an electrical department, that the change-over will be made in his territory at the expense of the company. In Albany, however, according to W. C. Furlong, secretary Municipal Gas Company, which also supplies electricity, only two changes have been made and the company is not advocating any wholesale alterations. In Cohoes S. J. Allan, superintendent Cohoes Light & Power Company, says, a survey similar to the one under way in Troy is being conducted and the change to 60 cycles is a possible outcome.

Fort Wayne Gets New Power Supply. —The Indiana Service Corporation of Fort Wayne, Ind., has completed its connection with the South Bend-Pittsburgh transmission line of the Insull system, which runs 3 miles north of the city, and the new service was placed in operation on Feb. 18. Robert M. Feustel, president of the corporation, asserts that the power business in Fort Wayne has grown so rapidly in the last two years that the capacity of the company's power house on Spy Run Avenue has been nearly reached. The new connection makes it possible for the corporation to obtain additional power up to 10,000 kw. from either South Bend, Ind., or Zanesville, Ohio.

Germany Has Train Telephone Service.—Germany is the first country in which it has become easy for passengers by rail to converse with the outside world. The picture gives an



exterior view of the railway-car radio-telephone exchange on the line between Berlin and Hamburg. The operator on the train is seen at her switchboard.

Commission Values Alabama Power Company at $82,000,000. — The total value of property owned by the Alabama Power Company in Alabama and devoted to the public service has been pleced at $81,990,648 by the chief engineer of the Alabama Public Service Commission. The greatest investment in one year since a valuation of $29,000,000 was made in 1920 was in 1923, the amount being $18,133,339. The next greatest was $13,760,578 in 1925. In 1924 the investment was $10,522,617, in 1922 $5,267,048, in 1921 $2,752,408, and during the six months in 1920 subsequent to the date of the original valuation the company's investments amounted to $2,554,636.

H. M. Byllesby Memorial Research Fellowships in Engineering. — Announcement is made by Lehigh University, Bethlehem, Pa., of two new research fellowships in engineering, founded by an endowment fund created by Mrs. Henry M. Byllesby, widow of the late president of the Byllesby Engineering & Management Corporation, who received his degree in mechanical engineering from Lehigh. Although the subjects to be investigated under the fellowships may be proposed by the president of the Byllesby corporation, the funds are to be administered and the work directed by the Institute of Research of Lehigh University. In common with all other activities of the institute, the work will follow lines of pure research and the results will be immediately available to the engineering profession. The two new fellowships will be awarded for a period of two academic years, with an annual stipend of $750 and freedom from university fees. Requests for information should be addressed to President Charles Russ Richards of Lehigh University.

Indianapolis Light & Heat Has a Budget of $1,170,000.—Expenditure in 1926 of $1,170,000 for extensions, betterments and improvements to plants has been authorized by the board of directors of the Indianapolis Light & Heat Company. The company last year spent $992,000 in this way. The largest general item for 1926 is one of about $500,000 for improvements to be made at the Mill Street and Kentucky Avenue stations of the company. Three new boilers are to be added to the present battery of twelve at the Mill Street station. At the Kentucky Avenue plant it is proposed to spend more than $125,000 for extension of railway switching facilities and in work preparatory to the installation next year of another turbine, with a generating capacity of 20,000 kw. The new turbine will cost $200,000 or more. For extensions and improvements of the present transmission system about $400,000 is to be spent. More than half of this will go toward building up and consolidating the present system and the remainder for new line extensions, meters, transformers and other equipment.

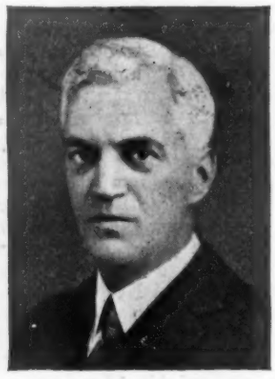
University of Colorado Starts Correspondence Course Directed by Utility Men.—The University of Colorado has inaugurated a correspondence course covering the economics of the utility business and has added to its faculty a group of utility company executives, members of the Rocky Mountain Committee on Public Utility Information, to direct the course, which will run throughout the summer months. Nine subjects are embraced in the course, with eighteen lessons in each. All of the problems and lessons have been worked out by the utility men, who will assist in correcting and grading papers. Students will be accepted from any part of the nation, Prof. Elmore Petersen, head of the extension division of the university, says, though a special effort will be made to enroll men and women who are employees of public utility organizations. The nine subjects are elements of public utility economics, valuation, rate making, regulation, taxation, financing, management, engineering and accounting. Lessons are 50 cents each and a year is allowed in which to complete a course. The dean of the utility "professors" is Herbert S. Sands of Denver, assistant district manager for the Westinghouse company.

Men of the Industry

J. C. Parker Appointed to Vice-Presidency in Brooklyn Edison

John C. Parker, electrical engineer for the Brooklyn Edison Company since 1922, has been appointed a vice-president of that company, according to an announcement made by Matthew S. Sloan, president, following the annual meeting last Tuesday. For seven years previous to his affiliation with the Brooklyn utility, Mr. Parker served as professor in charge of the department of electrical engineering at the University of Michigan, his alma mater. During this period he spent much time on the development of a general economic theory of engineering design with special reference to power plants and transmission lines.

Mr. Parker entered upon his career in the electrical engineering field as an employee in the testing department of



J. C. PARKER

the General Electric Company in 1901. Subsequently he became instructor in the new electrical engineering school at Union College, Schenectady, relinquishing his duties on the teaching staff there to go to Niagara Falls as engineer in charge of the plant of the Ontario Power Company. While at Niagara Falls he was intimately concerned with the construction of the transmission line of the Niagara, Lockport & Ontario Power Company as well as with the design and installation of the system of receiving stations and substations. In 1907 he became mechanical and electrical engineer for the Rochester (N. Y.) Railway & Light Company, resigning in 1915 to take the electrical engineering chair at the University of Michigan. Mr. Parker has been prominent in engineering association work, being actively identified with the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the National Electric Light Association.

Walter P. Holcombe, who has been purchasing agent of the company, was also appointed a vice-president. **Edward W. Kells**, who has been secretary of the company for the last six years, was elected a director to succeed the late Charles A. Boody. Mr. Kells will continue as secretary. **Harry P. Woodrow**, assistant electrical engineer, has been named electrical engineer to succeed Mr. Parker, and **L. B. Bonnett**, inside plant engineer, has been named purchasing agent to succeed Mr. Holcombe.

D. E. Manson Elected President of Vermont Company

Announement is made that **D. Edgar Manson** has been elected president of the Montpelier & Barre Light & Power Company, to succeed H. T. Sands, who has resigned. **Frank L. Ball** has been made operating vice-president of this company, which is under the management of Charles H. Tenney & Company, Boston. Mr. Manson heads several other utilities in the Tenney group, and Mr. Ball is resident manager of the Fitchburg (Mass.) Gas & Electric Company and will continue in that post. F. L. Lovett is resident manager of the Montpelier company.

William S. Schmidt has severed his connections with the Penn Public Service Corporation to join the Pennsylvania-Ohio Power & Light Company at Youngstown, Ohio.

H. S. Kirkpatrick, who has been assistant manager of the Ohio Power Company, with headquarters at Bellaire, has been appointed commercial manager for that company.

R. S. Pickup for several years manager of the Venango Public Service Corporation, with headquarters at Corry, Pa., has been assigned to Meadville, Pa., where he will become manager of the Northwestern Public Service Corporation.

James A. Perry, member of the Georgia Public Service Commission, was last Saturday elected chairman to succeed the late Paul B. Trammell. Mr. Perry has been a member of the commission since 1911. He was graduated from the University of Georgia in 1898, was Mayor of Lawrenceville, Ga., and a member of the Georgia State Legislature in 1900 and 1901.

E. M. Hervey, who has been connected with the Wisconsin Power & Light Company as manager of its Sheboygan electric properties for the last three years, has resigned from that post to enter business for himself as a consulting engineer in the power transmission field, in which he has specialized for 20 years. Prior to his promotion to manager Mr. Hervey was the company's electrical engineer at Sheboygan.

A. K. Ellis, vice-president of the Wisconsin Traction Light, Heat & Power Company and the Peninsular Power Company, will have supervision over the Niagara (Wis.) Light & Power Company and the Iron Mountain (Mich.) Electric Light & Power Company, which properties have been recently acquired by the North American Company. Max Sells of Florence, Wis., will be resident manager for the company in the territory.

A. W. Berresford Becomes Vice-President in Nizer Corporation

A. W. Berresford, who was vice-president and general manager of the Cutler-Hammer Manufacturing Company of Milwaukee for almost twenty years, has just been appointed executive vice-president of the Nizer Corporation, the Detroit manufacturer of Nizer electric ice-cream cabinets and automatic refrigerating units for other purposes. His appointment follows closely the announcement of a consolidation of the Nizer Corporation with the Kelvinator Corporation and the Grand Rapids Refrigerator Corporation, operating as divisions of the Electric Refrigeration Corporation.

For many years Mr. Berresford has been an outstanding figure in the electrical industry, which has been prompt in recognizing his eminent services. He is a past-president of the American Institute of Electrical Engineers and before election to that office in 1920 served as its vice-president and also as manager. He has also been president of the Electrical Manufacturers' Club

A. W. BERRESFORD

and of the Associated Manufacturers of Electrical Supplies and was recently elected vice-president of the American Engineering Council. Mr. Berresford became affiliated with the Cutler-Hammer Manufacturing Company in 1900 when that organization purchased the Ironclad Resistance Company, of which he was vice-president as well as general manager. In 1901 he was made superintendent of the Cutler-Hammer Company, in 1902 secretary, in 1905 general manager and in 1907 vice-president and general manager, the office from which he resigned early in 1923 to devote his attention to association work of various kinds in which he was interested. Mr. Berresford brings to the refrigeration industry a wealth of electric and general engineering knowledge as well as a fertile background of experience in major industrial enterprises.

E. R. Peacock has relinquished his duties as president of the Barcelona Traction, Light & Power Company, but has retained his seat on the board. Mr. Peacock will also continue to act as chairman of the bondholders' committee. **F. Fraser Lawton** has been appointed president and **H. Malcolm Hubbard** chairman.

Markham Cheever in New York

Markham Cheever, chief engineer and general superintendent of the Utah Power & Light Company, has resigned to join the staff of the Electric Bond & Share Company of New York. For the past fourteen years Mr. Cheever has been associated with the Utah Power & Light Company as chief engineer. He also took up the additional duties of general superintendent in 1918.

Mr. Cheever was born in Ann Arbor, Mich., and was graduated from the University of Michigan in 1903. Immediately after his graduation he became assistant engineer with the Ontario Power Company during the construction of the first section of the power development plants of Niagara Falls. From this company he went to Colorado and accepted a position as engineer in charge of the construction of a hydro-electric plant at Ames, Col. From 1908 to 1912 he served with the Telluride Power Company as assistant chief engineer.

When the Utah Power & Light Company was formed in 1912 by the consolidation of a number of existing com-

MARKHAM CHEEVER

panies, Mr. Cheever was made chief engineer. Under his direction the Bear River system, now operated by the Utah Power & Light Company, which is known throughout the country as a highly efficient system, embodying a tremendous water-storage development, absolute stream control and large generating stations, was created. Mr. Cheever has taken an active part in the affairs of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the National Electric Light Association.

J. A. Hale, who for the past thirteen years has been connected with the engineering department of the Utah Power & Light Company, has been promoted from the position of assistant chief engineer to that of chief engineer to succeed Mr. Cheever.

M. Schiller has been elected vice-president in charge of accounts and purchases of the Superheater Company, New York. **W. F. Jetter** has been elected treasurer and assistant secretary, and **Bard Browne** has been appointed assistant to the vice-president in charge of sales and service. All of these men have been long associated with the Superheater Company. Mr. Schiller joined the company in 1910, when it was organized as the Locomotive Superheater Company, and has served in various administrative and executive capacities. Mr. Browne entered the service of the company in 1914 and has been actively identified in the application of locomotive superheaters and feedwater heating devices, serving in various engineering, sales and service capacities.

Donald McNicol has taken office as president of the Institute of Radio Engineers. For many years Mr. McNicol has been in close touch with telegraph, telephone and radio developments in America as well as in foreign countries. He is a fellow of the A. I. E. E.

A. B. Gates, assistant manager of industrial relations of the Commonwealth Edison Company, Chicago, was elected president of the Industrial Relations Association of Chicago at the recent annual meeting of that organization. The purpose of this association, formed many years ago, is to "advance the understanding of the principles, policies and methods of creating and maintaining satisfactory human relations in business and in industry."

C. W. Kellogg, president of the Engineers' Public Service Company, has been made president of the General Public Service Corporation, organized a few months ago to invest in the securities of public utilities. The election of a permanent board of directors has just been completed, the board including representatives of Stone & Webster, Inc., Estabrook & Company, Blodgett & Company and Tucker, Anthony & Company.

Howard R. Sargent has been appointed engineer in the merchandise department of the General Electric Company. Mr. Sargent has been connected with the General Electric Company for more than thirty years and during that period has devoted much of his attention to the wiring supplies department. He is well known in electrical contracting and engineering circles and is a member of the American Institute of Electrical Engineers.

R. G. Winans has resigned as assistant engineer of the New York State Public Service Commission to become field supervisor with the Fitkin Utilities, Inc., under the direction of the General Engineering & Management Corporation, New York. Following graduation from Pratt Institute of Science and Technology Mr. Winans was employed in the testing and switchboard and central-station construction departments of the General Electric Company. He has been assistant engineer with the New York commission for twelve years.

Albion Davis, who has been affiliated with the Mississippi River Power Company since 1914, has been appointed chief engineer of that utility, recently acquired by the North American Company. After six years' association with the Keokuk company, Mr. Davis received the title of hydraulic engineer and in that capacity was responsible for the efficient hydraulic operation of the Keokuk plant. Last summer, when the hydraulic and engineering departments merged, he became engineer of the company, and now under the new ownership he has been made chief engineer. Mr. Davis is a member of the hydraulic power committee of the National Electric Light Association.

Peter William Sothman, long prominent in engineering circles in the United States and Canada, has been appointed consulting engineer of the Irish Free State in connection with power developments. Mr. Sothman brings to his new position a broad background in electrical engineering. For many years he was chief engineer of the Hydro-Electric Power Commission of Ontario and later engaged in consulting engineering work in Toronto and New York, relinquishing his practice in America in 1919 to go abroad. Upon his return to New York in 1924 he joined the staff of M. H. Avram & Company, engineers.

Ernst Jacobson Heads Portland Utility

Ernst Jacobson was elected president of the West Coast Power Company, with headquarters at Portland, Ore., at the recent annual meeting of that

ERNST JACOBSON

organization. Mr. Jacobson has been identified with the utility industry for many years, having been associated with the Insull organization in gas operations in the city of Chicago, chief engineer and vice-president of the Iowa Southern Utilities at Davenport and with the United Gas Improvement Company of Philadelphia. His experience has been a broad one, having to do with varied problems with which the utility business is confronted, and his duties with the West Coast Power Company will enable him to utilize his substantial knowledge. This company, though little more than a year old, is confronted with a large expansion program in the towns in which it operates, numbering about twenty in Oregon and Washington.

Obituary

Fred N. Florine of Portland, Ore., died Jan. 18 in that city after a protracted illness. A native of Vancouver, Wash., Mr. Florine entered the service of the Pacific Power & Light Company at Portland in 1910. Later he served this company at Yakima, Pendleton and more recently as district manager in Sunnyside.

Recent Court Decisions

No Presumption Exists in Favor of Special Rate Established by Commission.—Upsetting, in Atchison, Topeka & Santa Fe Railway Company vs. State, a special freight rate established by the State Corporation Commission of Oklahoma, the Supreme Court of that state said that where there was an appeal from special rates it would try the case *de novo*, declaring that "where a special rate has been substituted in place of a general and uniform rate no presumption exists in its favor, for the reason that the law will not indulge conflicting presumptions, and the presumption that a general and uniform rate is just, reasonable and correct is a superior and exclusive presumption." (241 Pac. 776.)*

Complaining Company Has Burden of Establishing Unjust Action by Commission.—Asserting that the Corporation Commission is vested with power to require all public service corporations to establish and maintain reasonable and just facilities and conveniences, the Supreme Court of Oklahoma, in St. Louis-San Francisco Railway Company vs. State, said that an appealing company had the burden of establishing the unreasonableness, unjustness or incorrectness of any order, and that it may do this by showing that such unreasonableness appears affirmatively from the facts as certified by the commission, or that it is shown by evidence in the record upon which the commission failed to make findings of fact or upon which the alleged facts found by the commission were erroneous. (242 Pac. 248.)

Jury Must Decide Questions of Negligence and Contributory Negligence Where Doubt Exists.—Damages for the death of a boy were awarded in McKiddy vs. Des Moines Electric Company, the boy having climbed a pole belonging to the company erected along a river adjoining a public park and been killed by coming into contact with high-voltage wires. The Supreme Court of Iowa, sustaining the award, said that the question of contributory negligence in the case of a child attracted by a "nuisance" was for the jury to decide, as was also the question of negligence on the part of an electric company which had erected such a pole on such land with no warning sign and no fence around it and with spikes facilitating climbing. No hard and fast rule could be laid down. (206 N. W. 815.)

Where Two Companies Are Negligent, Each Is Liable for Damages.—Where wires maintained concurrently by different parties are so erected that one is likely to fall upon or come into contact with the other, producing destructive consequences, each must exercise due care and diligence to abate the danger, and each is liable for negligence in allowing such a condition to remain, without regard to which one primarily caused it. So holding, the Supreme Court of Wisconsin affirmed judgment for the plaintiff in Dansbery vs. Northern States Power Company, a case where an employee of a laundry company was severely injured by electric shock, it being alleged that the current was transmitted over a guy wire leading to the smokestack of the laundry company with which the power company had negligently permitted a secondary service wire to come in contact. The fact that the laundry company could not be made a party to the suit, being subject to the compensation act, was not held a reason for reducing the amount of damages. (206 N. W. 882.)

Purchasers of Standing Timber, Not Sellers, Entitled to Payment for Trees Cut on Right-of-Way.—Cox vs. Kentucky-Tennessee Light & Power Company involved a dispute between the heirs of the owner of a right-of-way and parties to whom this owner had sold standing timber on the right-of-way, this sale taking place previously to the sale of the right-of-way itself to the light and power company. The latter company was to make payment for every tree cut or trimmed in building its line, and, the timber sold not having been cut by the purchaser, a question arose concerning whether the original owner of the right-of-way or those to whom the timber had been sold should be compensated by the utility company. The Court of Appeals of Kentucky confirmed a finding for the purchasers. (278 S. W. 571.)

Judgment of Circuit Court Fixing Rates Immediately Effective on Affirmation by State Supreme Court.—Coal District Power Company vs. City of Booneville concerned an attempt to ignore for the time being rates fixed by the Circuit Court and accepted by the city (of whose own rates the new ones were a modification), but which were appealed to the Arkansas Supreme Court, that court, however, supporting the findings of the lower judicial body. The company contended that these new rates would not take effect until the Supreme Court should issue a mandate enforcing its judgment. On final review the Supreme Court held that no mandate from it was required by law except in the case of a reversal of the lower court's findings, that rates fixed by the Circuit Court become enforcible immediately the appeal had been decided, and that the company was liable to a penalty for not at once putting them into effect. (278 S. W. 353.)

"Revenue Legislation" and Commission Jurisdiction in Relation to Franchise Contracts.—Sustaining a judgment for the plaintiff in a suit brought by the town of Fairfax against C. I. Huffaker to enforce a municipal contract with him as owner of the local power plant, the Supreme Court of Oklahoma laid down two principles in opposition to the contentions of the defendant. It held first that an ordinance granting a franchise giving the grantee a right to construct, maintain and operate for a specified term of years an electric lighting plant to supply the inhabitants of a community, with a proviso that such grantee should pay to the municipality 1½ per cent of the entire gross receipts of the plant when these exceeded $5,000 a year, was not an attempt to enact revenue legislation and hence unconstitutional. Second, it held that the fact that the plant was amenable to the jurisdiction of the Corporation Commission did not render the contract referred to invalid inasmuch as the commission did not exercise its paramount power to fix the rates to be charged by the utility company. (242 Pac. 254.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Note at High Interest Payable from Non-Utility Funds Is Disapproved.—The issue of a 10 per cent note secured by a mortgage on utility property was disapproved by the California Railroad Commission (Skidmore Brothers Corporation) where it appeared that while the note was a lien on the utility property only, it was an obligation of the corporation and that therefore payment on account thereof might be made out of revenues from non-utility property. The evidence showed that the principal when due would necessarily be paid out of the corporation's general fund, as there seemed to be little possibility of the earnings of the utility system increasing to the point where they would be sufficient for that purpose.

Tennessee Commissioner Attacks Purchase of Utility Companies by Others.—Asserting that the Railroad and Public Utilities Commission of Tennessee had heard no proof regarding the value of the Fayetteville Electric Power & Light Company, which the other two commissioners voted to permit the Southern Cities Power Company to purchase, Commissioner Porter Dunlap filed a dissenting opinion in which he said: "If public utilities are permitted to continue the practice of purchasing properties of other utilities at prices in excess of their value, they will soon be loaded down with unprofitable properties and will eventually be unable to render the efficient service that the demands of the future development in Tennessee will require."

Commission Refuses Jurisdiction Over Salaries or Extraordinary Expenses.—A mortgage provision that a utility company should not increase salaries or incur expenses of an extraordinary character, or any expense in excess of $5,000, without the written approval of the underwriter was disapproved by the California Railroad Commission in a case affecting the South Park Water Company. The provision was then amended by the applicant to prohibit any increase or incurring of extraordinary expense without the approval of the commission after written notice to the underwriter, in order to afford the latter an opportunity to be heard. This provision was also disapproved by the commission.

Financial and Corporate

Utility Market Irregular

Trading Volume Somewhat Reduced and Cautious Tone Appears—Bonds Are Stronger

FOLLOWING somewhat the movements of the general list of issues dealt in on the New York Stock Exchange, the power and light stocks failed to move as a whole either forward or backward in the week under review. Nothing like a definite major trend in the market for these stocks has made an appearance for weeks. Individual issues move ahead or lose ground according as special reasons occur to speculators for buying or selling different stocks, but at the end of each week there always is a mixture of declines and advances to record.

On the whole, it may be said that a greater demand is noticeable for the investment issues of established reputation, and in that class, of course, must first of all be mentioned the sound power and light bonds. Demands for bonds of quality far exceed the supply, and from all that can be judged at the moment this condition is one that may continue. Large insurance companies and individual investors continually are inquiring for good utility bonds, but the investment houses cannot supply the requests without, of course, bidding up the open market price to unwarranted levels. Good preferred stocks likewise are becoming more popular, and, for that matter, the common stocks of recognized merit, such as Consolidated Gas Company of New York and Brooklyn Edison Company, are strong.

Among the issues on the New York curb market and those not listed that have advanced may be mentioned Eastern Texas Electric, Puget Sound Power & Light, Tampa Electric, Commonwealth Power, Southeastern Power & Light and Northern Ohio Power. Losses were sustained, on the other hand, by United Gas Improvement, Georgia Railway & Power and Northern States Power.

New Capital Issues

During the past week the Public Service Company of Northern Illinois made an offering of first lien and refunding mortgage 5 per cent gold bonds, series C, amounting to $7,500,000. These bonds, due May 1, 1966, were priced at 98½ and interest, yielding about 5.08 per cent. Proceeds will be used to reimburse the company for expenditures made in connection with the enlargement of its Waukegan station and for extensions and additions and for the expansion of its general gas and electric service to provide for the rapid growth of its territory.

The Seattle Lighting Company participated in the week's financing to the extent of $1,500,000 in the form of 6 per cent sinking-fund gold debenture bonds priced at 98 and accrued interest, yielding about 6¼ per cent.

The Illinois Power & Light Corporation issued 7 per cent cumulative preferred stock to the amount of $2,000,000 at $100 per share and accrued dividend, to yield 7 per cent.

The Coldak Corporation, which produces and sells automatic electrical refrigerating machines for domestic and commercial uses, recently issued 360,000 shares of class A stock. The purpose of the offering was to acquire the assets owned, used and controlled by the Multicold Company, for which 47,500 shares have been set aside, and to furnish the Coldak Corporation with additional capital to provide for an increased production of Coldak units. The unplaced balance of the stock was offered on the market at $11 per share.

Company Reports

The following statements of earnings have been issued by electric light and power companies for the month of December:

Name of Company	Gross Earnings for December 1926	1925
Adirondack Power & Light*	$821,521	$757,544
Brazilian Traction, Lt. & Pwr.	3,111,251	2,443,315
Cleveland Elec. Illuminating	2,048,502	1,825,634
Cities Service*	1,861,769	1,670,453
Community Power & Light	316,414	252,900
Cumberland County Pwr. & Lt.	386,668	382,648
Detroit Edison*	†4,196,339	†3,564,804
Federal Light & Traction	570,394	559,569
Georgia Railway & Power	1,463,754	1,624,911
Havana Elec. Ry., Lt. & Pwr.	1,373,659	1,313,550
Milwaukee Electric Ry. & Lt.	2,301,099	2,117,244
Southern California Edison	2,046,454	1,749,703
Union Electric Light & Power	1,540,465	1,413,429
Wisconsin Electric Power	138,974	133,105
Wisconsin Gas & Electric	446,885	420,692

* January. † Includes other revenue.

Commonwealth Edison's Good Record

Policy of Regular Reductions in Rates and Improvement in Service Has Worked to Advantage of Insull Stockholders Over a Long Period

By PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

SPEAKING before a group of public utility executives in Chicago on Nov. 11, 1921, Samuel Insull said: "If the rights of the public are properly taken care of in producing lower costs and steadily improving service, the rights of the stockholders will take care of themselves." That policy is one that the Commonwealth Edison Company itself, under the Insull management from the time of its organization, has tested during a long period of years; and, it may be added, the ability of the company regularly to reduce its rates at different intervals and to improve its service has worked greatly to the advantage of the stockholders, for today not many common stocks in the whole investment list occupy so strong a position of favor as do the shares of this leading Insull utility.

A visit to the company's new Crawford Avenue station, following an inspection of its oldest plant still in operation, shows what progress has been in the last generation in increased efficiency of operation. Already the operation of the Crawford Avenue station has been reflected in the earning figures, and as time goes on and additional units are added greater and greater benefits will be recorded. It is through such developments that Commonwealth Edison has just been able to report its common dividend, after liberal charges for depreciation, earned by a handsome margin in 1925.

The ability of this world-famous company recently to sell successfully an issue of bonds bearing a coupon rate of only 4½ per cent, the lowest rate attempted in offerings of that description since the war, must be partly explained by the favorable money conditions of the period and the unusual popularity of public utility bonds nowadays, but it must also be explained by the confidence in Commonwealth Edison management that has been built up over a long period of years.

In the annual statement just issued for the year 1925 the company reports that its business was much larger than that of the preceding year, the operating revenues showing an increase of more than $5,000,000. The total electrical output for the year, including energy purchased and resold, was 3,091,424,000 kw.-hr., compared with 2,787,090,000 kw.-hr., for 1924, an increase of nearly 11 per cent. On Dec. 31, 1925, the number of customers was 811,366, compared with 755,233 on Dec. 31, 1924. The increase was 7.4 per cent. During the year 67,621 additional meters were installed. The total consumption of coal in 1925 was 3,062,856 tons as against 2,953,237 in 1924. The year 1925 was remarkable in the company's history for the amount of new business secured, the total new load contracted for being 249,000 kw. This was an increase of 61 per cent over the increase in 1924. Of the new business 56 per cent was for power and 44 per cent for light.

Operating revenues totaled $58,691,584 and operating expenses $36,262,409, leaving a net operating revenue of $22,429,175. Balance carried to surplus after dividends, interest, etc., amounted to $3,563,844. During the year there was added to retirement reserve $4,932,967, and in keeping with the company's practice the original cost of that part of the company's property abandoned on account of wear, obsolescence, inadequacy or other causes,

amounting to $2,640,071, was charged against retirement reserve, making the net increase in retirement reserve $2,292,896.

Detroit Edison Company Special and Annual Meeting.—At a special meeting of the stockholders of the Detroit Edison Company, held Feb. 1, the stockholders approved the proposed increase in the authorized capital stock of the company from $85,000,000 to $120,000,000 par value. No plans were announced for the issuing of the new stock at this special meeting, it not being the company's intention to offer any of this increased stock at this time.

Southeastern Power Stock Increase Voted.—Stockholders of the Southeastern Power & Light Company at a meeting held in Augusta, Me., voted approval of the proposal to increase the 3,600,000 no-par capital shares to 4,850,000 shares. Authorized capitalization is now 4,000,000 shares of common, 100,000 shares of $7 preferred, 100,000 shares of $6 preferred and 650,000 shares of participating preferred stock.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Feb. 20	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com. —no par	k 82	71¼	84¼
Adirondack Pwr. & Lt.—7% pf.	k104	....	....
Adirondack Pwr. & Lt.—8% pf.	110	108	110
Adirondack Pwr. & Lt., com.—50	m 75	n 31	n 98
Ala. Pwr., pf.	k104	....	....
Allis-Chalmers Mfg. pf.	109¼	109	110
Allis-Chalmers Mfg., com.	k 89	88¼	94¼
Aluminum Co. of Amer., com.	k 76	55	76
Aluminum Co. of Amer. new, pf.	k 98½	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m127	127½	131
Amer. & Foreign Pwr., 7% pf.—no par	k 95½	91	98
Amer. & Foreign Pwr., com.—no par	k 35½	35	42¼
Amer. Bosch Magneto, com—no par	k 28½	28¼	34¼
Amer. Brown Boveri Elec.	k 41	39¼	48¼
Amer. Brown Boveri Elec. pf.	k 95½	95½	97½
Amer. Elec. pwr., pf.	c103½	101½	105
Amer. Gas & Elec., 6% pf.—no par.	k 95	92½	95½
Amer. Gas & Elec., com.—no par.	k 92½	80	99¼
Amer. Lt. & Trac., 6% pf.	113	113	115½
Amer. Lt. & Trac., com.	k246	232	263
Amer. Pwr. & Lt., 6% pf.	k 94	93½	96
Amer. Pwr. & Lt., com.—no par.	k 72	68¼	79½
Amer. Pub. Serv., 7% pf.	k 96	....	....
Amer. Pub. Serv., com.	47	45	80
Amer. Pub. Utilities, 4% pf.	k 88	....	....
Amer. Pub. Utilities, 6% pf.	90	85	86
Amer. Pub. Utilities, 7% pf.	k 100	....	....
Amer. Pub. Utilities, com.	80	80	82
Amer. States Sec., A	k 8	....	....
Amer. States Sec. B	k 5½	....	....
Amer. Superpwr., pf.—25	26	25	26
Amer. Superpower, pf.	92	93	94
Amer. Superpwr., Class A—no par.	k 34	33¼	37½
Amer. Superpwr., Class B—no par.	k 35½	34½	39
Amer. Wtr. Wks. & Elec., 7% pf.	k104	102½	108½
Amer. Wtr. Wks. & Elec., com.—20.	k 67	65½	74
Anaconda Copper	k 48½	46½	51
Appalachian Pwr., 7% pf.	101	99	101
Appalachian Pwr., 1st pf., 7%	102	99	101
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 79	....	....
Arizona Pwr., com.	34	34	36
Arkansas Cent. Pwr., pf., $7—no par	101½	99	102
Arkansas Lt. & Pwr., 7% pf.	k 99	....	....
Arkansas Lt. & Pwr., com.	100	100	102
Asheville Pwr. & Lt., 7% pf.	l103	100½	104
Assoc. G.&E., 7% pf.—1% extra—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 80	....	....
Assoc. Gas & Elec., Class A—no par	k 31½	30	35½
BABCOCK & WILCOX, com.	k143	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	....	....
Birmingham Elec. pf.—$7—no par.	103	102	103½
Blackstone Valley Gas & Elec., pf.	103	102	106
Blackstone Valley G.&E., com.—50.	101	....	....
Blaw-Knox, com.	f 52	52	56
Brazilian Trac., Lt. & Pwr., com.	f 98½	....	....
Broad River Pwr., pf.	95½	94	98
Brooklyn Edison, com.	k144	133½	146½
Buffalo Gen. Elec., com.—no par.	m 58	n 50	n 77
Buffalo, Niagara & East. Pwr., pf.—25	k 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	k 33½	....	....
CALIFORNIA ELEC. GENERATING, pf.	92½	89	93
California Ry. & Pwr., pf.	88	88	92
Carolina Pwr. & Lt., pf.—$7—no par	105½	105	107
Carolina Pwr. & Lt., com.	m420	n290	n456½
Cent. & S. W. Ut. 7% pf.—no par	a 94	89½	94
Cent. & S. W. Ut., pr. ln. pf.—no par	a 99	96½	100
Central Ariz. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	k 99	....	....
Central Ill. Pub. Serv., 6% pf.	89	89	91
Central Ind. Pwr., 7% pf.	91	89	93½
Central Pwr. & Lt., pf.	96½	95½	98
Central States Elec., 7% pf.	k 94½	90	99
Central States Elec., com.	200	200	230
Century Elec., com.	m103	n103	n110
Chicago Fuse Mfg., com., no par.	a 34	32	35
Cincinnati Gas & Elec., com.	g 92½	89	92½
Cities Service, 6% pf.	83½	83½	84½
Cities Service, pf. B—10	k 7½	....	....
Cities Service, pf. BB—100	k 77	....	....
Cities Service, com.—20	k 40½	....	....
Cities Service, Bks. Shrs.—10	k 19	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	104	104	105½
Cleveland Elec., Illg., com.	k240	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	k114½	113	115
Columbia Gas & E., com.—no par.	k 84½	83½	90
Columbia Ry., Gas & Elec., 6% pf.	95	95	96
Columbus Elec. & Pwr., 2d pf.	k102	....	....
Columbus Elec. & Pwr., com.	k175	....	....
Columbus Ry., Pwr. & Lt., 1st. pf.	98	98	99
Columbus Ry., Pwr. & Lt., pf. B.	92	92	95
Col. Ry., Pwr. & Lt., com.—no par.	82	82	85
Commonwealth Edison, com.	a141½	139½	144
Commonwealth Pwr., 6% pf.	k 87	85	87½
Commonwealth Pwr., com—no par.	k 41½	39	42½
Conn. Lt. & Pwr., 8% pf.	118	118	121
Conn. Lt. & Pwr., 7% pf.	110	110	113
Cons. Gas of N. Y., pf.—80.	k 59	....	....
Cons. Gas of N.Y., com.—no par.	k104½	94½	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e103½	102	103½
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf.	e109½	108½	110
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e114½	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e128½	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 54	45	57½
Cons. Utilities of Dela., 7% pf.	m 85	n 80	n 84
Consumers Pwr., 6% pf.	97	95	98
Consumers Pwr., 6.6% pf.	103	101½	103½
Continental Gas & Elec., 7% pfc. pf	k100	101½	103½
Continental Gas & Elec., 7% pr. pf.	98	95½	98½
Continental G.&E., com.—no par.	145	143	150
Crocker Wheeler, com.	18	14	19
Crocker Wheeler, pf.	50	50	55
DALLAS PWR. & LT., 7% pf.	103	102	104
Dayton Pwr. & Lt., 6% pf.	97½	95	97
Dayton Pwr. & Lt., com.	m420	n180	n460
Detroit Edison, com.	k135	133	141½
Dubilier Condenser & Radio, com. no par.	k 7½	7½	11
Dubuque Elec., 7% pf.	95	93	97
Duquesne Lt., 7% pf.	k113½	112½	114
EAST, N. Y. UTIL. pf.	70	....	....
Eastern New York Util., com.	55	....	....
Eastern States Power.	k 29	....	....
Eastern States Pwr., pf. with warrants	m120	....	....
Eastern States Pwr., pf. without warrants.	k 91	....	....
Eastern Tex. Elec., 7% pf.	k105	....	....
East. Tex. Elec., com.—no par.	k107½	....	....
Edison Elec. Illum. of Boston, com.	d232	207	250
E. Paso Elec., com.—no par	k 85	....	....
E. Paso Elec. pf.	k102	....	....
Elec. Bond & Share, 6% pf.	l105½	103½	107½
E. Bd. & Share Sec., com.—no par.	l 80	79	86
Elec. Investors, 6% pf.—no par.	98	92	95
Elec. Investors, com.—no par.	k 64½	62½	74½
Elec. Investors, 10% pd. receipts.	45	....	....
Elec. Pwr. & Lt., ctfs. pf.	k 96½	91½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	110½	105½	115
Elec. Pwr. & Lt., ctfs. full pd.	110	107	110½
Elec. Pwr. & Lt., ctfs., com.—no par	k 31	30	34½
Elec. Ry. Securities, com.—no par.	7	....	....
Elec. Refrig.	k 77½	75	90½
Elec. Storage Battery, com.—no par.	k 77½	73	79½
Elmira Wtr., Lt. & R. R., 7% pf.	99	97½	99½
Emerson Elec. pf.	m103½	100	104½
Empire Dist. Elec., 6% pf.	80	80	85
Empire Pwr., A.	k 31	....	....
Eng. Pub. Serv., pf.—no par.	k103½	99½	104
Engr. Pub. Serv., com.—no par.	k 29	24	29½
Eureka Vac. Cleaner, com.—no par.	k 51	47	53½
FAIRBANKS MORSE, com—no par	k 54½	51	59½
Fairbanks Morse, pf.	110	108½	115
Federal Lt. & Trac., com.	k 38½	35½	39½
Federal Light & Traction, pf.	86	87	89
Federal Utilities, pf.	k 75	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l105	105	107
GALVESTON-HOUSTON ELEC., 6% pf.	k 60	....	....
Galveston-Hstn El., com.	k 21	....	....
Gen. Elec., com.	k384	323	386½
Gen. Elec., special—10.	k 11½	11	11½
Gen. Gas & Elec., A.	m 52	51½	59
Gen. Gas & Elec., pf. A.	m 98½	98½	99½
Gen. G.&E., (Del.) com. A no par.	52½	51½	55
Gen. G.&E., (Del.) com. B no par.	37	40	47
Gen. G.&E., (Del.) A pf. $8—no par	108½	98	110
Gen. G.&E., (Del.) A pf. $7—no par	87½	97	99
Gen. G.&E., (Del.) B pf.	95½	95	97½
General Public Service, com.	k 15½	13½	15½
General Public Service, pf.	k104½	103	106½
Ga. Lt., Pwr. & Rys., 6% pf.	81	82	85
Ga. Lt., Pwr. & Rys., com.	65	59	70
Ga. Ry. & Elec., 5% pf.	m 70	n 78½	n 84½
Ga. Ry. & Elec., com.	m126	n115½	n115½
Ga. Ry. & Pwr., 8% pf.	112	112	114
Ga. Ry. & Pwr., 7% pf.	102	101½	103
Ga. Ry. & Pwr., 4% pf.	135	140	145
Ga. Ry. & Pwr., com.	k135	....	....
Gt. Western Pwr., 7% pf.	h101	....	....
HAVANA ELEC. UTIL., com.	44	43½	44½
Havana Elec. Util., pf.	71½	68½	71½
Hurley Machine, com.—no par.	m 50½	44½	51
IDAHO PWR., 7% pf.	103	103	104
Ill. No. Utilities, 6% pf.	k 88	....	....
Ill. Pwr. & Lt., 7% pf.	k 99	....	....
Ingersoll Rand.	96	90	104
Int. Combt. Engr., com.—no par.	k 54	50½	64½
Int. Utilities, class A—no par.	k 36	35½	39
Int. Utilities, class B—no par.	k 7½	7½	9½
Interstate Pwr., pf., $7 no par.	92½	92	98
Interstate Pub. Serv., 7% pf.	96½	96½	97
Iowa Ry. & Lt., 7% pf.	97	98	100
JERSEY CENTRAL PWR. & LT. 7% pf.	95½	95½	96½
Jersey Central Pwr. & Lt., com.—no par.	45	45	50
Johns-Manville, com.—no par.	k145	142½	159
KANSAS CITY PWR. & LT., pf.	k110½	107½	110½
Kansas Gas & Elec., 7% pf.	l100½	99½	102
Kelvinator Corp., com.—no par.	k 76	76	89½
Kentucky Hydro-Elec., pf.	a 95	92	95
Kentucky Sec., 6% pf.	77	75	77
Kentucky Sec., com.	k 90	....	....
Kentucky Utilities, 6% pf.	90	90	95
Keystone Pwr. & Lt. 7% pf.	96	95	97
Kings County Ltg., 7% pf.	103	103	106
Kings County, Ltg., 8% pf.	104	105	108
LACLEDE GAS LT., com.	k164	160½	168
Lehigh Pwr. Sec., com.—no par.	18½	17½	22
Long Island Ltg., 7% pf.	105	105	107
Long Island Ltg. com.—no par.	145	145	150
Los Angeles Gas & Elec., 6% pf.	96	95½	97
Louisville Gas & Elec., Class. A	k 25½	22½	26½
MANHATTAN ELEC. SUPPLY.	k 72½	56	76½
Manila Elec., com.—no par.	k 35	30	32½
Maytag Mfg., com.	k 22	21½	23½
Memphis Pwr. & Lt., pf., $7, no par	103½	103	105
Metro. Edison, pf.—$6—no par.	93	92½	98
Metropolitan Edison, pf., $7, no par.	102½	102	106
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a110	97½	111½
Middle West Utilities, 7% pr. lien pf.	a120	106½	123½
Middle West Utilities, com.—no par.	a126	115½	134½
Midland Utilities, pr. ln. pf.	a 99½	99	100
Midland Utilities pf. A	a 96½	96	96½
Milwaukee Elec. Ry. & Lt., 7% pf.	97	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	87	83½	87
Minn. Pwr. & Lt., 7% pf.	l102	100½	103½
Miss. Pwr. & Lt., pf.	m102	....	....
Miss. River Pwr., 6% pf.	95	94	96
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	103	101	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	95½	93	97
Mohawk Hudson Pwr., com.—no par	23	23	27
Montana Pwr., pf.	m 118	112½	118
Montana Pwr., com.	k 79	77½	83½
Montreal Pwr., com.	f 224½	....	....
Mountain States Pwr., pf.	k 96	....	....
Mountain States Pwr., com.	k 25	....	....
NASSAU & SUFFOLK. LTG., pf.	93	93	95
National Carbon, com.	m124	n120	n130
National Carbon, pf.	a126	125	127½
National Elec. Pwr., pf.	a 94	93	96½
National Electric Pwr-A	a 24	23½	26
Nat.-Lt., Ht. & Pwr., com.—no par.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	71	71	73
National Pwr. & Lt., pf., $7—no par.	k100½	....	....
National Pwr. & Lt., com.—no par.	k 31½	30	38½
National Pub. Serv., 7% pf.	92½	90	94
National Pub. Serv., ptc. pf.	94	96	97½
National Pub. Serv., A com.—no par	k 22½	21½	24
National Pub. Serv., B com.—no par	16½	13½	17½
Nebraska Pwr., 7% pf.	l 104	103	105½
Nevada-Calif. Elec., com.	29	29	44½
New Brunswick Pwr., pf.	35	30	40
New England Pub. Serv., pr. ln. pf.	98	98	99½
New England Pub. Serv., pf.	92	95½	97
N. J. Pwr. & Lt., 7% pf.	104	104	108
New Orleans Pub. Serv., 7% pf.	101½	100	102
New Orleans Pub. Serv., com.—no par.	m 30	n 31	n 38½
N. Y. Central Elec., 7% pf.	98½	98	100
Newport News & Hampton Ry., Gas & Elec., com.	108	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	108	109	114
Niagara Falls Pwr., 7% pf.—25.	28½	28	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	m101	n101½	n110
Niagara, Lock. & Ont. Pwr., com.—no par.	m 60½	n 60	n 73
Nizer Corp., A.—no par.	m 84½	n 37	n 84½
Nizer Corp., B.—no par.	80½	76	89½
No. Amer., 6% pf.—50.	k 50	49	50½
No. Amer., com.—10.	k 63½	63½	67
No. Amer. Edison pf.—no par.	k 93	93	95
No. Amer., Lt. & Pwr., pf.	88	88	90
N.C. Pub. Serv., pf.—$7—no par.	k 91	....	....
Northeastern Pwr., com.	k 33½	31	36½
No. Indiana Gas & Elec., pf. A.	98	98	100
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 21	15½	26½
No. Ohio Trac. & Lt., 6% pf.	79	78	81
No. Ohio Trac. & Lt., 7% pf.	89	88	91
No. Ont. Lt. & Pwr., pf.	78	78	84
No. Ont. Lt. & Pwr., com.	54	49	68
No. States Pwr., 7% pf.	k100½	....	....
No. States Pwr. com.	k126½	125½	136½
No. Texas Elec., 6% pf.	k 58	....	....
No. Texas Elec., com.	k 40	....	....
OHIO BRASS, com. B—no par.	74	72	79
Ohio Brass, pf.	99	98	101
Ohio Gas & Elec., 7% pf.	90	92	95
Ohio Pwr., 6% pf.	93	93½	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	99	98½	100
Ohio River Edison, pf.	100	100	101
Oklahoma Gas & Elec., pf.	k 98	....	....
PACIFIC GAS & ELEC., 6% pf.	k 97	....	....
Pacific Gas & Elec. com.	k129½	126½	132½
Pacific Pwr. & Lt., 7% pf.	l100½	98	101½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, Feb. 23. lBid, low, high, Wednesday, Feb. 24. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Feb. 20	Low 1926	High 1926
STOCKS—Continued			
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr., pf.—no par	c 73½	72½	73½
Penn-Ohio Elec., 7% pf.	93	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	95	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	101	100	106
Penn Pwr. & Lt.—$7—no par	l105	103	106
Penn Pub. Serv., 7% pf.	98	96	100
Penn Pub. Serv., 6% pf.	85	85	90
Penn Wtr. & Pwr., com.	e163	160½	171
Phila. Co., pf.—50	c 49½	48	49½
Phila. Co., com.—50	k 68	63	70½
Phila. Elec., com.—25	c 63½	54½	67½
Pittsburgh Utilities, pf.—10	15½	15½	16½
Portland Elec. Pwr., 7% pf.	97½	97	98
Portland Elec. Pwr., 6% pf.	72½	71	75
Portland Elec. Pwr., com.	k 44½	44½	48½
Portland Ry., Lt. & Pwr.,pf.	m 72½	....	....
Portland Ry., Lt. & Pwr., com.	m 49	....	....
Potomac Elec. Pwr., pf.	j107	....	....
Pwr. Corp. of N. Y., 7% pf.	m110	n 96	n112
Pwr. Corp. of N.Y., com—no par	k 79	77½	90½
Pwr. Sec., pf.—no par	k 22	....	....
Pwr. Sec., com.—no par	k 9	....	....
Pub. Serv. of N. J., 7% pf.	k108	103½	108½
Pub. Serv. of N. J., 8% pf.	118	115½	119
Pub. Serv. of N. J., com.—no par	k 86	79½	92½
Pub. Serv. of No. Ill., 6% pf.	a101	100½	102½
Public Serv. of No. Ill., 7% pf.	a115½	112	115½
Pub. Serv. of No. Ill., com.—no par	a136	130	137
Pub. Serv. of No. Ill., com.	a133	130	135
Pub. Serv. of Okla., 7% pf.	94	92	95
Pub. Serv. Elec. & Gas, 6% pf.	k 99½	97	99½
Puget Sound Pwr. & Lt., 7% pf.	k106	....	....
Puget Sound Pwr. & Lt., 6% pf.	k 84	....	....
Puget Sound Pwr. & Lt., com.	k 56	....	....
Radio Corp. of Am., pf.—50	46½	45½	47½
Radio Corp. of Amer., com.—no par	k 41½	37½	46½
Republic Ry. & Lt., pf.	k107	....	....
Republic Ry. & Lt., com.	96	90	97
Rochester Gas & Elec., 8% pf.	95	80	98
Rochester Gas & Elec., 6% pf.	100	100	102
Rochester Gas & Elec., 7% pf.	104	105	107
St. Joseph Ry., Lt., Ht. & Pwr., pf.	65	60	65
Servel Corp., Class A	k 26½	26½	30½
Servel Corp., Class B—no par	k 56	....	....
Sierra Pacific Elec., com.	k 25½	24	28½
Sioux City Gas & Elec., 7% pf.	97	96	98
S. E. Pwr. & Lt., 7% pf.—no par	99	98	100
S. E. Pwr. & Lt., com.—no par	k 38½	37½	46½
So. Calif. Edison, 8% pf.	135	135	140
So. Calif. Edison, 7% pf.	k111	....	....
So. Calif. Edison, 6% pf.	k 97	....	....
So. Calif. Edison, com.	k132½	128	142
Southern Cities Utilities, 7% pf.	88	87	89
Southern Cities Utilities, com.	k 48	....	....
Southern Pwr. & Lt. of Md., pf.	m107	....	....
Southern Pwr. & Lt. of Md., com.	m 32	....	....
Southwestern Lt. & Pwr., A	k 45	....	....
Southwestern Lt. & Pwr., B	k 45	....	....
Southwestern Lt. & Pwr., 6% pf.	k 80	....	....
Southwestern Pwr. & Lt., 7% pf.	k102	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	96	....	....
Standard Gas & Elec., 8% pf.	k 57½	54½	k 57½
Standard Gas & Elec., 7% pf.	k102	....	....
Standard Gas & Elec., com.—no par	k 64½	55½	69
Standard Pwr. & Lt., 7% pf.	k 91	....	....
Superheater, com.—no par	k144	....	....
Syracuse Lighting, 7% pf.	105	105	107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	265	260	275
Tampa Elec., com.	k315	292	321½
Tenn. Elec. Pwr., 6% pf.	k 88	....	....
Tenn. Elec. Pwr., 7% pf.	k101	....	....
Tenn. Elec. Pwr., pf.—$6—no par	m 80	....	....
Tenn. Elec. Pwr., com.—no par	m 65	....	....
Terre Haute, Ind. & East Trac., pf.	27	33	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.	l103½	102	104½
Tide Water Pwr., 8% pf.	k100	....	....
Timken Roller Bearing, com—no par	k 53½	52½	56½
Toledo Edison, 8% pf.	112	112	114
Toledo Edison, 7% pf.	k101½	....	....
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	88½	87½	89
United Gas & Elec., 6% pf.	95½	94	97
United Gas & Elec., com.—no par	61	56	66
United Gas & Elec. (N.J.), 5% pf.	73	70	75
United Gas Impr.—50	c126½	119	144½
United Lt. & Pwr., pf.—$4—no par.	49	49	51
United L. & P. pf.—$6.50—no par.	89	88	91
United Lt. & Pwr., com., A—no par	133	125	143½
United Lt. & Pwr., com., B—no par	155	150	165
Utah Pwr. & Lt., 7% pf.	l102½	99	103½
Utica Gas & Elec., 7% pf.	105	103	105
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	92½	92	98
Utilities Pwr. & Lt., com. B—no par.	k 16½	15½	17½
Vermont Hydro - Elec., 7% pf.	95	95	96
Virginia Pwr., 7% pf.	102	102	104
Virginia Pwr., com.	65	....	....
Virginia Ry. & Pwr., com.	m149	n 64½	n150
Wagner Elec., pf.	b 82	82	85
Wagner Elec., com.—no par	b 26	26	34½
Washington Ry. & Elec., com.	j226	....	....
Washington Ry. & Elec., pf.	j 90½	....	....
Washington Wtr. Pwr., com.	130	130	134
West Mo. Pwr., 7% pf.	k 91	....	....
West Penn., 7% pf. tem. ctfs.	100½	96½	100
West Penn, com.	125	123	130
West Penn Elec., pf.	100	96½	100½
West Penn Elec., Class A	95½	88½	97
West Penn Pwr., pf.	k109	108½	112
West Va. Lt., Ht. & Pwr., 7% pf.	95	95	98
West Va. Utilities, 7% pf.—50	43	43	45
Western Pwr., 7% pf.	k 98	....	....
Western Pwr., com.—no par	m 80	n 34	n102
Western States Gas & Elec., 7% pf.	90	89	92
Western States Gas & Elec., com.	k 19½	....	....
Westinghouse El. & Mfg., com—50	k 75½	72	79½
Weston Elec. Instrument, Class. A	k 31½	27½	31½
Weston Elec. Instrument, com.	k 18½	15½	19
Wheeling Elec., pf.	92½	91	93½
Wis.-Minn. Lt. & Pwr., 7% pf.	m 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	77	77	80
Worthington Pump, pf. B	63½	60	64½
Worthington Pump, com.	k 39	37½	44½
Yadkin River Pwr., 7% pf.	l104	102	105
Yale & Towne, com.—25	63½	62½	64½
BONDS			
Abitibi Pwr., & Paper	6s	1940	k100	....	....
Adir. Elec. Pwr.	5s	1962	k100½	....	....
Adir. Pwr. & Lt.	6s	1950	k106	....	....
Adir. Pwr. & Lt.	5s	1930	97	98	99½
Ala. Pwr.	5s	1946	99½	99	100½
Ala. Pwr.	5s	1951	97½	97	99½
Ala. Pwr.	6s	1951	104½	104½	105½
Ala. Trac., Lt. & Pwr.	5s	1962	119	120	124
Aluminum Co. of Amer.	7s	1933	k107½	106½	107½
Amer. Bosch Magneto	8s	1936	m103	....	....
Amer. Gas & Elec.	5s	2007	92	92	93½
Amer. Gas & Elec.	6s	2014	99	99	99½
Amer. Pwr. & Lt.	6s	2016	k 97½	96	98
Amer. Pub. Serv.	6s	1942	99½	98½	100½
Amer. Wtr. Wks. & Elec.	5s	1934	k 97½	....	....
Amer. Wtr. Wks. & Elec.	6s	1975	k 94½	93½	94½
Anaconda Copper	6s	1929	103½	102½	103½
Anaconda Copper	6s	1953	k104	....	....
Anaconda Copper	7s	1938	k106	....	....
Appalachian Pwr.	5s	1941	k 99	....	....
Appalachian Pwr.	6s	2024	94½	93½	95
Appalachian Pwr.	7s	1936	105½	105	106½
Arizona Pwr.	6s	1933	100	99½	101
Arizona Pwr.	6s	1947	96	95½	97
Ark. Central Pwr.	6s	1948	102½	102	103½
Ark. Lt. & Pwr.	6s	1945	k104	....	....
Ark. Lt. & Pwr.	6s	1954	100½	99	101½
Assoc. Gas & Elec.	6s	1965	k 93½	93	94½
Assoc. Gas & Elec.	6½s	1954	k101	....	....
Binghamton Lt., Ht. & Pwr.	5s	1946	k 99½	....	....
Birmingham Elec.	6s	1954	103½	102½	104
Birmingham Ry., L. & P.	4½s	1954	90	88	91
Broad River Pwr.	6½s	1934	100½	100	102
Brooklyn Edison	5s	1949	103½	103	105½
Brooklyn Edison	6s	1930	106½	103½	106½
Buffalo Gen. Elec. 1st	5s	1939	102	101½	102½
Buffalo G. E., 1st & Ref.	5s	1939	101½	101½	102
Buffalo G. E.	5s	1956	101½	99½	101½
Burlington Ry. & Lt.	5s	1932	97	96	97½
Butte Elec. & Pwr.	5s	1951	k100½	....	....
Calif. Elec. Gen.	5s	1948	k100½	....	....
Calif. Gas & Elec.	5s	1937	100	100½	101½
Calumet Gas & Elec.	5½s	1960	97½	97½	98½
Canadian Lt. & Pwr.	5s	1949	59	56	62
Canton Elec.	5s	1937	100	100	101
Carolina Pwr. & Lt.	5s	1938	100½	100½	101½
Carolina Pwr. & Lt.	6s	1953	104½	104½	105½
Cedar Rap. Mfg. & Pwr.	5s	1953	99½	99½	100½
Central Ark. Ry. & Lt.	5s	1928	99½	99	100½
Central Ga. Pwr.	5s	1938	95½	95	96½
Central Ill. Lt.	5s	1943	k 98½	....	....
Central Ill. Pub. Serv.	5s	1952	92½	92	93½
Central Ill. Pub. Serv.	5½s	1950	96	96	97
Central Ill. Pub. Serv.	6s	1944	99½	99	101½
Central Ind. Pwr.	6s	1947	98½	98	99½
Central Ia. Pwr. & Lt.	6s	1944	100½	99½	101
Central Maine Power	5s	1939	98½	98½	100
Central N. Y. Gas & El.	5s	1941	k 98	....	....
Central Pwr. & Lt.	6s	1946	m101½	n 97½	n101½
Central Pwr. & Lt.	6½s	1952	k104	....	....
Central States Elec.	5s	1926	m 99	....	....
Chattanooga Ry. & Lt.	5s	1956	84	81	85
Cincinnati Gas & Elec.	5s	1956	k103½	....	....
Cincinnati Gas & Elec.	5½s	1961	k104½	....	....
Cities Service	6s	1966	k 93½	93½	93½
Cities Service	7sB	1966	k185	178	185
Cities Service	7sC	1966	k129½	125½	129½
Cities Service	7sD	1966	k103	101½	103
Cities Service	7sE	1966	k108	....	....
Cities Service Pwr. & Lt.	6s	1944	k 94½	93½	94½
City L. & T., Sedalia, Mo	5s	1952	84	83	85½
Cleveland Elec. Illum.	5s	1939	102½	102½	103½
Cleveland Elec. Illum.	5s	1954	k102½	....	....
Cleveland Elec. Illum.	7s	1941	111	110	112
Colorado Pwr.	5s	1953	96½	95½	97½
Columbia Gas & Elec.	5s	1927	100	99½	101
Columbia Ry., Gas & El.	5s	1936	92½	92½	95
Columbus, Dela. & Marion Elec.	5s	1937	84	83½	86
Columbus, Dela. & Marion Elec.	6s	1937	94	93½	96
Columbus Elec. & Pwr.	6s	1947	k102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940	k 98	....	....
Columbus Ry., Pwr. & Lt.	6s	1941	k102	....	....
Commonwealth Edison	5s	1943	k102½	....	....
Commonwealth Edison	5s	1953	100	99½	101
Commonwealth Edison	5s	1954	k100	....	....
Commonwealth Pwr.	5s	1939	k 91½	....	....
Commonwealth Pwr.	6s	1972	k 96	....	....
Commonwealth Pwr.	6s	1947	103½	102½	105
Community Pwr. & Lt.	6s	1950	98½	98	99½
Conn. Ry. & Ltg.	4½s	1951	k 91½	....	....
Consol, Cities Lt., Pwr. & Trac.	5s	1962	80½	80	82½
Consol. Elec.	5s	1955	98	98	99
Consol. Gas of N. Y.	5½s	1945	105½	....	....
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935	c 97½	97½	98
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949	c106½	105½	107
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s	1965	100½	100	101
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952	c105½	104½	105½
Consumers Elec. L. & P.	5s	1936	k 97	....	....
Consumers Elec.	5s	1936	k 97	....	....
Consumers Pwr.	5s	1952	k100½	....	....
Consumers Pwr.	5½s	1954	k103½	....	....
Continental Gas & Elec.	5s	1927	k100	....	....
Continental Gas & Elec.	6s	1947	k101½	....	....
Continental Gas & Elec.	6½s	1964	k 99	....	....
Continental Gas & Elec.	7s	1954	k107	....	....
Cumberland County P. & L.	5s	1942	95	94	96½
Dallas Pwr. & Lt.	6s	1949	104	104	105
Dayton Ltg.	5s	1937	100	100	101
Dayton Pwr. & Lt.	5s	1941	k 99½	....	....
Defiance Gas & Elec.	5s	1942	98½	98	99
Denver Gas & Elec.	5s	1949	98½	98	100
Denver Gas & Elec. Lt.	5s	1951	k 94½	....	....
Des Moines Elec.	5s	1938	100	99	100½
Detroit Edison	5s	1933	k102½	....	....
Detroit Edison	5s	1940	k102½	....	....
Detroit Edison	5s	1949	101	100	102½
Detroit Edison	5s	1955	100½	100½	101½
Detroit Edison	6s	1932	m135	135	135
Detroit Edison	6s	1940	k107½	....	....
Detroit Edison	7s	1928	m134	....	....
Detroit Edison	7s	1929	m138½	....	....
Detroit Edison	7s	1930	m138½	134½	138½
Dominion Pwr. & Trans	5s	1932	95½	95	96½
Driver-Harris	8s	1931	96	95	98
Dubuque Elec.	6s	1942	102½	102	103½
Duke-Price Pwr.	6s	1949	102½	102	103½
Duquesne Lt.	6s	1949	k106½	....	....
Duquesne Lt.	5½s	1949	105½	105	106½
Durham Pub. Serv.	7s	1949	100	99	101½
East Penn. Elec.	6s	1953	105½	105	106
East Oregon Lt. & Pwr.	6s	1929	100	100	101
East. Tex. Elec.	5s	1942	k 96	....	....
Economy Lt. & Pwr.	5s	1956	99	99	100
Edison Elec. Illum. of Boston (notes)	4½s	1928	99½	99½	100½
Edison Elec. Illum. of Bklyn.	4s	1939	94½	93	99½
Edison El. Illum. (N.Y.)	5s	1995	103½	103	104½
El Paso Elec.	5s	1932	k102	....	....
El Paso Elec.	5s	1950	95	95	96
El. Pwr. Corp. (Germany)	6½s	1950	k 87½	....	....
Elec. Refrigeration	6s	1936	k103½	103½	107
Elmira Wtr., Lt. & R.R.	5s	1956	96	96	97
Empire Dist. Elec.	5s	1949	92½	92	93½
Erie Ltg.	5s	1967	99½	99	100½
Evansville G. & El. Lt.	5s	1932	99½	99½	100
Federal Lt. & Trac.	5s	1942	k 94½	....	....
Federal Lt. & Trac.	6s	1942	k104½	....	....
Federal Lt. & Trac.	6s	1954	k 94½	....	....
Florida Power & Light	5s	1954	k 93½	93½	93½
Florida Publ. Service	6s	1955	97	97	99
Florida Public Service	6½s	1949	99½	100	103
Ft. Smith Lt. & Trac.	5s	1936	76	75½	78
Ft. Worth Pwr. & Lt.	5s	1931	100	99	100½
Galveston Elec.	5s	1940	90	89	92
General Elec.	3½s	1942	87	87	88½
Georgia Carolina Pwr.	5s	1952	87½	87	89
Ga. Lt., Pwr. & Rys.	5s	1941	89	88	90
Ga. Ry. & Elec.	5s	1932	99½	98½	100½
Ga. Ry. & Elec.	5s	1949	96	95	97
Ga. Ry. & Pwr.	5s	1954	97½	96	99
Ga. Ry. & Pwr.	6s	1947	k104	....	....
Ga. Ry. & Pwr.	7s	1941	k105	....	....
German Gen. Elec.	6½s	1940	99½	93½	99½
German Gen. Elec.	7s	1945	98½	95	98½
Great Cons. Elec. Pwr. (Japan)	6½	1950	86	85½	86
Great Cons. Elec. Pwr. (Japan)	7s	1944	k 93½	....	....
Great Falls Pwr.	5s	1940	102½	101½	103½
Great Northern Pwr.	5s	1935	99½	98½	100
Great Western Pwr.	5s	1946	k 99½	....	....
Great Western Pwr.	5½s	1955	100½	99	101
Great Western Pwr.	6s	1949	102½	102	103½
Great Western Pwr.	6s	1952	102½	102	103½
Hamburg Elec.	7s	1935	95½	94	96½
Havana Elec. R., Lt. & P	5s	1954	m 93	92½	93½
Holtwood Pwr.	6s	1954	104½	100	104½
Houston Ltg. & Pwr.	5s	1931	99½	99	101
Houston Ltg. & Pwr.	5s	1953	95½	90½	95½
Houston Ltg. & Pwr.	5½s	1954	100	99½	102½
Hydraulic Pwr.	5s	1951	101½	101½	102
Hydraulic Pwr.	5s	1950	101½	101½	103
Idaho Pwr.	5s	1947	97½	96	98½
Ill. Elec. Pwr.	6s	1943	102½	102	103½
Ill. Pwr.	5s	1933	93½	93	95½
Ill. Pwr.	6s	1944	k 98	....	....
Ill. Pwr. & Lt.	5½s	1954	98	97½	99
Ill. Pwr. & Lt.	6s	1953	101	100½	102½
Ill. Pwr. & Lt.	7s	1953	103	102½	103½
Ind. Elec.	6s	1947	98½	98	100
Ind. Gen. Serv.	5s	1948	97½	96½	98½
Ind. Lighting	4s	1958	83½	82½	84
Indiana & Mich. Elec.	5s	1955	96	96	97
Indiana & Mich. Elec.	5s	1957	98	97½	99
Ind. Pwr.	7½s	1941	m105½	n104	n106
Ind. Service	5s	1950	92	91½	93
Ind. Service	6s	2020	87½	86½	88½
Ingersoll-Rand	5s	1935	100	....	....
Interstate Elec.	6s	1933	95½	94	96½
Interstate Pwr.	6s	1944	k 97½	....	....
Interstate Pwr.	7s	1934	k101	....	....
Interstate Pub. Serv.	6s	1948	98½	98	99½
Iowa Ry. & Lt.	5s	1932	98½	97½	99½
Iowa Southern Utilities	5½s	1950	95	94	96
Jersey Cent. Pwr. & Lt.	5½s	1945	95½	95	96½
Kansas City Pwr. & Lt.	5s	1952	k102½	....	....
Kansas Elec. Pwr.	6s	1937	100½	100	101½
Kansas Elec. Pwr.	6s	1943	100½	99½	101½
Kansas Gas & Elec.	6s	1952	k103½	....	....
Kansas Gas & Elec.	6s	2022	93	92½	93½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMont real; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, Feb. 23. lBid, low, high, Wednesday, Feb. 24. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday Feb. 20	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec....	6s	1949	100½	101½
Kentucky Utilities.....	6s	1949	100½	101½
Kings Cty. Elec. L. & P..	5s	1937	103½	102 103
Kings Cty. Elec. L. & P..	6s	1997	122½	120½ 123
Kings County Ltg.....	5s	1954	99½	98½ 100½
Kings County Ltg.....	6½s	1954	107½	106 108½
Knoxville Ry. & Lt.....	5s	1946	95½	95½ 97
LACLEDE GAS LT.....	5s	1934	k101½	....
Laclede Gas Lt.....	5½s	1953	104½	102½ 104½
Laurentian Pwr.....	6s	1936	100	100 101
Laurentide Pwr.....	5s	1946	99½	100 102
Lehigh Pwr. Sec.....	6s	2026	k 95½	25 95½
Lincoln Gas & Elec.....	5s	1941	93½	92½ 94½
Long Island Ltg.....	5s	1936	100	99 100½
Long Island Ltg.....	6s	1954	k101	100 101½
Long Island Ltg.....	6s	1948	105½	104½ 106
Los Angeles Gas & Elec..	5s	1939	k 99	....
Los Angeles Gas & Elec..	5½s	1943	100	99 100½
Los Angeles Gas & Elec..	5½s	1947	k100	....
Los Angeles Gas & Elec..	5½s	1949	100	99 101
Los Angeles Gas & Elec..	6s	1942	103½	102½ 104
Louisiana Pwr.....	6s	1944	99	98½ 100
Louisville Gas & Elec....	5s	1952	k 99½	....
Louisville Gas & Elec....	5½s	1954	103	102 103½
Lower Austrian Hydro El.	6½s	1944	k 87½	....
Luzerne Cty. Gas & El...	5s	1948	98	97½ 99½
Luzerne Cty. Gas & El...	7s	1944	104½	103½ 105½
Luzerne Cty. Gas & El...	6s	1954	103½	102 104
MADISON RIV. PWR...	5s	1935	100½	100 101
Manila Elec.....	7s	1942	k103	....
Manila Elec. Ry. & Ltg..	5s	1953	90½	89½ 91½
Manitoba Pwr.....	7s	1941	k105½	103½ 105½
Memphis Pwr. & Lt.....	5s	1948	99½	99 100½
Metropolitan Edison.....	6s	1952	106½	104 106½
Metropolitan Edison.....	5s	1953	k 99	....
Metropolitan Pwr.....	6s	1953	104½	102½ 104½
Michigan Lt.....	5s	1946	k 99½	....
Michigan No. Pwr.....	5s	1941	98½	97 99
Milwaukee El. Ry. & Lt..	5s	1926	95½	99½ 99½
Milwaukee El. Ry. & Lt..	4½s	1931	99½	98 99
Milwaukee El. Ry. & Lt..	5s	1951	k 99½	....
Milwaukee El. Ry. & Lt..	5s	1961	k 94½	....
Milwaukee El. Ry. & Lt..	6s	1953	104½	100½ 104½
Minn. Pwr. & Lt.....	5s	1955	96½	95½ 97
Minn. Pwr. & Lt.....	6s	1950	105½	104 105½
Miss. Power.....	5s	1955	93½	92 94
Miss. River Pwr.....	5s	1951	k 99½	 94
Miss River Pwr.....	7s	1935	102	102 103
Mo. Edison Elec.....	5s	1927	m100½	100½ 100½
Mobile Elec.....	5s	1946	k 98	....
Monongahela W. Pa. Pub. Service.....	5½s	1953	95½	95 97½
Montana Pwr.....	5s	1943	101½	99½ 101½
Montgomery Lt. & W.P..	5s	1943	m 93	n 86½ n 93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97 98½
Montreal Lt., Ht. & Pwr.	5s	1933	99½	99½ 101
Montreal Pub. Serv.....	5s	1942	94½	94 95½
Mountain States Pwr.....	6s	1938	99	98½ 100
NASHVILLE RY. & LT.	5s	1953	97½	96½ 98½
Nashville Ry. & Lt.....	5s	1958	91½	90½ 92½
Nassau Lt. & Pwr.....	5s	1927	99½	98½ 100½
Nassau & Suffolk Ltg....	5s	1945	90	89½ 91
National Elec. Power.....	6s	1945	93	92½ 94
National Pwr. & Lt.....	7s	1972	k103½	....
National Pub. Serv.....	6½s	1955	95	94½ 95½
Nebraska Pwr.....	5s	1949	99½	99 100½
Nebraska Pwr.....	6s	2022	95	94½ 95½
Nevada-Calif. Elec.....	6s	1946	k 99½	....
Nevada-Calif. Elec.....	6s	1950	99½	98½ 100
New Brunswick Pwr.....	5s	1937	82	81½ 83
New England Pwr.....	5s	1951	101½	100½ 102½
New Jersey Pwr. & Lt....	5s	1936	97½	96½ 98
New Orleans Pub. Serv...	4½s	1935	88	87 88½
New Orleans Pub. Serv...	5s	1952	k 93	....
New Orleans Pub. Serv...	5s	1955	m 92½	90½ 92½
New Orleans Pub. Serv...	6s	1949	90½	90 91½
N.Y. & Queens El. L.&P..	5s	1930	100½	100½ 103½
N.Y. & Westchester Ltg..	4s	2004	80½	79½ 81½
N.Y. & Westchester Ltg..	5s	1954	98	97½ 98½
New York Edison.....	6½s	1941	116	115½ 116½
New York Edison.....	5s	1944	103½	102 103½
N.Y. Gas & El. L., H.&P.	5s	1948	104½	104 105
N.Y. Gas & El. L., H.&P.	4s	1949	90½	89½ 90½
N.Y. State Gas & Elec...	5½s	1962	100½	100 101
Newport News & Hampton Ry., Gas & Elec....	5s	1944	90	89½ 91
Niagara Falls Pwr.....	5s	1932	101½	100½ 102½
Niagara Falls Pwr.....	6s	1932	105	105 106½
Niagara Falls Pwr.....	6s	1950	105½	105 106½
Niagara, Lock. & Ont. Pwr.	5s	1954	m 98½	n104½ n110
Niagara, Lock. & Ont. Pwr.	5s	1955	100½	99 100½
Niagara, Lock. & Ont. Pwr.	6s	1958	m100½	....
Norfolk Ry. & Lt.....	5s	1949	95	94 95½
No. Amer. Edison.....	6s	1952	104	101½ 104½
No. Amer. Edison.....	5½s	1948	105½	103½ 106
No. Amer. Lt. & Pwr.....	7s	1954	99½	99 100½
North Caro. Pub. Serv...	5s	1934	92½	92 93½
North Caro. Pub. Serv...	6s	1954	95	94½ 96
North Caro. Pub. Serv...	6½s	1944	99	98 100½
North Shore Elec.....	5s	1940	99½	98½ 100½
No. Calif. Pwr.....	5s	1948	100½	99½ 101½
No. Ind. Gas & Elec.....	5s	1929	99	99 100
No. Ind. Gas & Elec.....	6s	1952	104½	5102½ 105
Northern N. Y. Utilities..	5½s	1949	100	100 101½
No. Ohio Pwr.....	7s	1935	m 95½	....
No. Ohio Trac. & Lt.....	4s	1933	87	87 89
No. Ohio Trac. & Lt.....	5s	1956	84	84 86
No. Ohio Trac. & Lt.....	6s	1926	99	99 100
No. Ohio Trac. & Lt.....	6s	1947	94	92½ 95½
No. Ontario Lt. & Pwr...	6s	1931	m100	n 95½ n100½
No. States Pwr.....	6½s	1933	123½	123 131
No. States Pwr. (notes)....	6½s	1933	103½	103 104½
No. States Pwr.....	6s	1948	103½	103 104
No. States Pwr.....	6s	1941	105½	105½ 106½
No. States Pwr.....	5s	1941	99½	97½ 100
No. Tex. Elec.....	5s	1940	70	72 75
Northwestern Elec.....	6s	1935	102½	102 103½
Northwestern Pub. Serv..	6½s	1948	100	99½ 100½
Nova Scotia Tr. & Pwr...	5s	1946	88	88 90
OHIO PWR......	5s	1952	95½	94 95½
Ohio Pwr.....	6s	1953	103½	103½ 104½
Ohio Pwr.....	6s	2024	95½	95½ 96½
Ohio Pwr.....	7s	1951	105½	105½ 106½
Ohio Pub. Serv.....	5s	1954	93½	92½ 94½
Ohio Pub-Serv.....	6s	1953	101½	101 102½
Ohio Pub. Serv.....	7½s	1946	112½	112½ 113½
Ohio Pub. Serv.....	7s	1947	110½	110½ 111½
Ohio River Edison.....	6s	1948	103	102 104
Okla. Gas & Elec.....	5s	1950	93½	93 94½
Okla. Gas & Elec.....	6s	1940	96½	96½ 97½
Ontario Pwr. of Niagara Falls.....	5s	1943	100½	99½ 101
Ontario Transmission.....	5s	1945	99½	99½ 99½
Ozark Pwr. & Wtr.....	5s	1952	77	77 78
PACIFIC COAST PWR...	5s	1940	99½	99 100½
Pacific Gas & Elec.....	5s	1942	99½	97½ 100
Pacific Gas & Elec.....	5s	1955	m 93½	n 94 n 95½
Pacific Gas & Elec.....	5½s	1952	102½	101½ 103½
Pacific Gas & Elec.....	6s	1941	107½	106 108
Pacific Lt. & Pwr.....	5s	1942	101	100 101½
Pacific Lt. & Pwr.....	5s	1951	100½	100 101½
Pacific Pwr. & Lt.....	5s	1930	k100	....
Pacific Pwr. & Lt.....	5s	1953	m 96½	....
Parr Shoals Pwr.....	5s	1952	97	95 97½
Paterson & Passaic G.&E.	5s	1949	100½	100 100½
Penn Central Lt. & Pwr..	6s	1953	104½	102½ 105
Penn Edison.....	5s	1946	98	96½ 98½
Penn. Elec.....	6s	1955	93	92 94
Penn Elec.....	6½s	1954	98	97 98½
Penn.-Ohio Edison.....	6s	1950	105½	98½ 106
Penn Ohio Elec.....	6½s	1938	107	105 107
Penn Ohio Pwr. & Lt.....	5½s	1954	m 99½	....
Penn Ohio Pwr. & Lt.....	6s	1939	97½	97 98½
Penn Pwr. & Lt.....	5s	1952	98	98 99
Penn Pwr. & Lt.....	5s	1953	98½	98 99
Penn Pwr. & Lt.....	6s	1953	105	105 106
Penn Pwr. & Lt.....	7s	1951	106	105½ 106½
Penn Pub. Serv.....	5s	1954	97½	96 98
Penn Pub. Serv.....	6s	1947	104	103 105
Penn Wtr. & Pwr.....	5s	1940	102½	101½ 102½
Penn Wtr. & Pwr.....	5½s	1953	103½	102½ 103½
Phila. Co.....	6s	1944	104½	103½ 105
Phila. Co.....	5½s	1938	100½	98½ 100½
Phila. Co.....	5s	1951	98½	97½ 99½
Phila. Co.....	5s	1949	m104½	103½ 104½
Phila. Elec.....	5s	1966	c103½	102½ 104½
Phila. Elec.....	4s	1966	c 85½	84 85½
Phila. Elec.....	5s	1960	c102½	102 103
Phila. Elec.....	6s	1941	c108	107½ 108½
Phila. Elec.....	5½s	1947	c107½	106½ 107½
Phila. Elec.....	5½s	1953	c107½	106 107½
Portland Elec. Pwr.....	6s	1947	k101	....
Portland Gen. Elec.....	5s	1935	100½	99½ 100½
Portland Ry., Lt. & Pwr..	5s	1942	91½	88½ 93
Portland Ry., Lt. & Pwr..	6s	1947	100½	99 101
Portland Ry., Lt. & Pwr..	7½s	1946	107½	106½ 108
Potomac Edison.....	6s	1949	100	99 100½
Potomac Edison.....	6½s	1948	103½	103 104
Potomac Elec. Pwr.....	5s	1929	j100½	....
Potomac Elec. Pwr.....	5s	1936	j100½	....
Potomac Elec. Pwr.....	6s	1953	j107½	....
Potomac Elec. Pwr.....	7s	1941	j106½	....
Power Corp. of N. Y....	6s	1942	101½	101 101½
Power Corp. of N. Y....	6½s	1942	104½	104 105½
Power Securities.....	6s	1949	k 77	....
Pub. Lt. & Pwr.....	5s	1945	72	70 73
Pub. Serv. Co. of Colo...	5½s	1954	95½	95 96½
Pub. Serv. Co. of Colo...	6s	1953	100	100 101½
Pub. Serv. Co. of Colo...	7s	1933	101½	101½ 102½
Pub. Serv. Corp. of N.J..	5s	1959	104½	104½ 105
Pub. Serv. Corp. of N.J..	6s	1944	k102½	....
Pub. Serv. Co. of No. Ill..	5s	1956	99½	98 99
Pub. Serv. Co. of No. Ill..	5½s	1962	104½	104 105
Pub. Serv. Co. of No. Ill..	5½s	1964	104½	104 105½
Pub. Serv. Co. of Okla...	6s	1949	99½	98½ 100½
Pub. Serv. Elec. & Gas...	5½s	1959	k105½	....
Pub. Serv. Elec. & Gas...	5½s	1964	k104½	....
Pub. Util. Evansville, (Ind.)	6s	1929	100½	99½ 101
Puget Sound Pwr.....	5s	1933	99½	99 100½
Puget Sound Pwr. & Lt...	5½s	1949	k100½	....
QUEBEC PWR.....	6s	1953	102½	101½ 102½
Queensborough Gas & E..	5s	1952	99½	99½ 100½
Queensborough Gas & E..	6s	1953	104	104 105½
RHINE-WESTPHALIA ELECTRIC PWR.....	7s	1950	96	93½ 96
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94	93 94½
Robbins & Myers.....	7s	1952	63	60 66½
Rochester Gas & Elec....	5½s	1948	105½	105½ 106
Rochester Gas & Elec....	7s	1946	112½	112½ 114
Rochester Ry. & Lt.....	5s	1954	101	100½ 101½
Rockford Elec.....	5s	1939	99½	99½ 100½
ST. MAURICE PWR....	6½s	1953	109	108 109½
St. Paul Gas Lt.....	5s	1944	100½	100½ 101½
St. Paul Gas Lt.....	5½s	1954	101½	101 102½
St. Joseph Ry., Lt., H.&P.	5s	1937	93½	91½ 97
Salt River Valley Wtr....	6s	1938	k100	....
Salmon River Pwr.....	5s	1952	100½	100½ 101½
San Antonio Gas & Elec..	5s	1949	96½	96 97½
San Antonio Pub. Serv...	6s	1952	103½	101½ 103½
San Diego Cons. G.&E....	5s	1939	100½	100 101½
San Diego Cons.G.&E....	6s	1939	101½	101 102½
San Joaquin Lt. & Pwr...	5s	1945	99½	98½ 100
San Joaquin Lt. & Pwr...	6s	1950	103½	103 104½
San Joaquin Lt. & Pwr...	6s	1952	103	99½ 103½
San Joaquin Lt. & Pwr...	6s	1954	101½	100½ 102½
Sauda Falls.....	5s	1955	96	94½ 96
Savannah Elec. & Pwr....	7½s	1941	k104½	....
Saxon Pub. Wks. (Germany).....	7s	1945	95½	92½ 96
Scranton Electric.....	5s	1937	102	101½ 102½
Seattle Elec.....	5s	1930	101	100½ 101½
Seattle Elec.....	5s	1929	100	99½ 100½
Seattle Elec.....	5s	1939	93	92½ 94½
Seattle Ltg.....	5s	1949	91½	90½ 92½
Shawinigan Wtr. & Pwr..	5s	1934	100½	100 101½
Shawinigan Wtr. & Pwr..	5½s	1950	104	103½ 104½
Shawinigan Wtr. & Pwr..	6s	1950	105	104½ 105½
Sheboygan Elec.....	5s	1946	95½	94½ 96½
Siemens & Halske.....	7s	1928	99½	96½ 100
Siemens & Halske.....	7s	1935	96½	94 96½
Sierra & San Fran. Pwr...	5s	1949	77	77 77½
Sierra & San Fran. Pwr....	6s	1949	77	77 77½
Sioux City Gas & Elec....	6s	1947	102	101½ 102½
Sioux City Gas & Elec....	6s	1949	102½	102 103½
So. Caro. Gas & Elec.....	6s	1942	80	84 90
So. Caro. Gas & Elec.....	6s	1932	75	75 80
Southeast Pwr. & Lt. (ex-warranto).....	6s	2025	91	91½ 92½
So. Cal. Edison.....	5s	1939	100½	100 101
So. Cal. Edison.....	5s	1944	98½	98 99½
So. Cal. Edison.....	5½s	1944	103½	103 104
So. Cal. Edison.....	6s	1943	103½	102 104
So. Cal. Edison.....	6s	1944	105	105 106
So. Cities Utilities.....	8s	1931	98	99 102
Southern Colo. Power....	6s	1947	k 98½	....
So. Ind. Gas & Elec.....	6s	1947	m97½	....
Southern Pwr.....	5s	1930	100	100 101
So. Public Utilities.....	5s	1943	100½	100 101½
So. Sierras Pwr.....	6s	1936	103	102½ 104½
So. Utilities.....	6s	1933	m102	n 97½ n102½
So. Wisconsin Pwr.....	5s	1938	91½	91 93
Southwestern Gas & E....	5s	1932	97½	97 98½
Southwestern Gas & E....	6s	1957	98½	97½ 99½
Southwestern Lt. & Pwr..	6s	1937	98½	98 99½
Southwestern Power.....	6s	1944	96½	96½ 98
Southwestern Pwr. & Lt..	5s	1943	95	94 96
Southwestern Pwr. & Lt..	6s	2022	94½	94 96
Southwestern Pub. Serv..	6s	1945	94	94 96
Southwestern Utilities....	8s	1936	94	94 96
Springfield Ry. & Lt.....	5s	1926	99½	100½ 100½
Standard Elec. of Cal....	5s	1939	100	99½ 101
Standard Gas & Elec.....	6s	1935	k 99	....
Staten Island Edison.....	6½s	1953	106	106 107½
Superior Water, Lt. & Pwr.	4s	1931	94½	94½ 95½
Syracuse Ltg.....	5s	1951	99½	100½ 100½
Syracuse Ltg.....	5½s	1954	103½	103½ 104½
TAMPA ELEC......	5s	1933	k 99	....
Tenn. Elec. Pwr.....	6s	1947	k104½	....
Tenn. Pwr.....	5s	1962	96	96 97
Tex. Pwr. & Lt.....	5s	1937	99	98½ 100
Tex. Pwr. & Lt.....	6s	2022	96	95½ 97
Tide Water Pwr.....	6s	1942	100½	100 101½
Tide Water Pwr.....	7s	1937	100½	100 101½
Toho Elec. Pwr. (Japan).	7s	1955	m 91½	....
Tokyo Elec. (Japan).....	6s	1928	m 98½	....
Toledo Edison.....	5s	1947	99½	99½ 100½
Toledo Edison.....	7s	1941	k109½	....
Toledo Gas, Elec. & Htg.	5s	1935	98	98 100½
Toledo Tr., L.&P. (notes)	5½s	1930	98½	98 99
Topeka Edison.....	5s	1930	99	99 100
Topeka Ry. & Lt.....	5s	1933	94½	94½ 96½
Trenton Gas & Elec.....	5s	1949	100½	100½ 100½
Tri-City Ry. & Lt.....	5s	1930	m 98½	....
Twin State Gas & Elec....	5s	1953	95½	95 96½
Twin State Gas & Elec....	5½s	1945	98	98 99
Tyrol Hydro-Elec. Pwr...	7½s	1955	m 96½	n 94½ n 97
UJIGAWA ELEC PWR.	7s	1945	92½	92 94
Union Elec. Lt. & Pwr...	5s	1932	100½	100½ 102½
Union Elec. Lt. & Pwr...	5s	1933	100½	100½ 100½
Union Elec. Lt. & Pwr...	5s	1954	99½	99½ 101
Union Elec. Lt. & Pwr...	5½s	1954	101½	100½ 102½
United Elec. of N.J.....	4s	1949	87½	87½ 89
United Elec. Lt. & Pwr...	4½s	1929	98	98 99½
United Gas & Elec.....	6s	1945	m101½	n 98 n101
United Lt. & Pwr. (notes)	5½s	1928	99½	99 100½
United Lt. & Pwr.....	5½s	1959	98	96 97½
United Lt. & Pwr.....	6½s	1974	97½	96 98½
United Lt. & Rys.....	5s	1932	m 96½	....
United Lt. & Rys.....	6s	1926	100	100 101½
United Lt. & Rys.....	6s	1952	99½	99 100½
United Lt. & Rys.....	6s	1973	90½	89½ 92
United Pwr. & Lt.....	6s	1944	102½	102 103½
United Water, G. & E....	5s	1941	94	94 95
Utah Lt. & Trac.....	5s	1944	k 88½	....
Utah Pwr. & Lt.....	5s	1944	k 96½	....
Utah Pwr. & Lt.....	6s	1944	103	102½ 104½
Utah Pwr. & Lt.....	6s	2022	93½	88½ 94½
Utica Elec. Lt. & Pwr....	5s	1950	101½	100½ 101½
Utica Gas & Elec.....	5s	1957	101½	100½ 101½
Utica Gas & Elec.....	5½s	1949	104	103½ 104½
VERMONT HYDRO-ELEC......	6s	1929	100½	100 101
Vicksburg Lt. & Trac....	5s	1932	94½	93½ 93½
Virginian Pwr.....	5s	1942	95½	88 97
Virginian Pwr.....	6½s	1954	103½	103 104½
Virginia Ry. & Pwr.....	5s	1943	98½	97½ 99
Virginia-Western Pwr....	6s	1953	101½	101½ 102½
WAGNER EL. MFG....	7s	....	b101½	100½ 101½
Washington Coast Util...	6s	1941	103	102½ 103½
Washington Ry. & Elec...	4s	1951	j 80½	....
Washington Ry. & Elec...	6s	1933	j 103	....
Washington Wtr. Pwr....	5s	1939	101½	.... 102½
West Penn Pwr.....	5s	1963	101½	101½ 101½
West Penn Pwr.....	5s	1946	101	99½ 101
West Penn Pwr.....	5½s	1953	105½	104½ 106
West Penn Pwr.....	7s	1946	106½	105½ 106½
W. Va. Lt., Ht. & Pwr...	6s	1929	102½	101 102½
West Virginia Utilities....	6s	1935	96	95½ 97½
W. Va. Water & Elec.....	6½s	1942	103	102½ 104
Westchester Ltg.....	5s	1950	102½	102½ 103½
Western Elec.....	5s	1944	100½	100½ 101
Western N. Y. Utilities...	5s	1946	97	96½ 98
Western Pwr.....	6½s	1954	100½	100½ 101½
Western Pub. Service....	6s	1950	98½	98 99½
West States Gas & Elec...	5s	1941	98½	98½ 99½
West States G.&E. (notes)	6s	1937	94½	94½ 96
West States Gas & Elec...	6s	1947	k 99	....
West United Gas & El....	5s	1950	102	101½ 102
West United Gas & El....	6s	1950	m102	n100 n102½
Westphalia Un. Elec. Pwr	6½s	1950	98½	99 100
Westinghouse El. & Mfg.	7s	1931	105½	105½ 106½
Wheeling Elec.....	5s	1941	98½	99 100
Wichita R. R. & Lt.....	5s	1932	85	83 88
Winnipeg Elec.....	6s	1954	96½	96 97½
Wisconsin Elec. Pwr.....	5s	1954	99	98½ 99½
Wisconsin Gas & Elec....	5s	1952	99½	99½ 100½
Wis.-Minn. Lt. & Pwr....	5s	1944	95½	95½ 96½
Wisconsin Pwr., Lt. & Ht	5s	1946	92	92 98
Wisconsin Pub. Service...	6s	1952	101½	101½ 102½
Wis. Ry., Lt. & Pwr....	5s	1933	96	89 93½
Wis. River Pwr.....	5s	1941	93	92½ 94
Wolverine Pwr.....	7s	1943	100½	100 101½
YADKIN RIVER PR...	5s	1941	99½	f 99 100½
Yarmouth Lt. & Pwr.....	5s	1937	83	83 87
Yarmouth Lt. & Pwr.....	8s	1951	99	99 102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, Feb. 23. lBid, low, high, Wednesday, Feb. 24. mLatest quotations available. n1925.

Manufacturing and Markets

The Need for a Uniform Ordinance

Economic Burden of Inconsistency in Inspection Standards—Police Power Behind Local Codes Needs Regulation in Public Interest

By S. L. NICHOLSON
Chairman Uniform Code Committee Electrical Manufacturers' Council

THIS is the first of a series of articles written by Mr. Nicholson at the request of the ELECTRICAL WORLD to present in simple detail the code, test, inspection and regulating functions as at present organized and operating in the electrical industry. Mr. Nicholson has been one of the outstanding figures among the electrical manufacturers in the development of better organization in that branch of the industry and the working out of an orderly procedure in the revision and maintenance of the code. What he says on these subjects, therefore, should be of very practical interest to every electrical man.

FOR several years the Electrical Manufacturers' Council has been gradually developing, refining and introducing a model uniform electrical ordinance for the purpose of providing a guide that may be followed in the drawing of municipal regulations for the installation of electric wiring and equipment. The idea of such an ordinance has now received the indorsement of all the branches of the electrical industry affected, and wherever the ordinance has been adequately presented it has aroused the favorable interest of both the electrical fraternity and the municipal authorities, for it is generally regarded as the best means so far devised to bring order out of what is now a state of confusion. Already in a large number of communities this uniform ordinance has been used as the basis for new or revised regulations now satisfactorily completed or in process, and with the co-operation of local electric leagues a practical method has been set up for assisting municipalities in the framing of ordinances.

The need for such a uniform ordinance, however, has not been generally appreciated by many electrical men who have not had occasion to observe the costly influence of the inconsistency of inspection standards throughout the country.

INSPECTIONS IN EARLY DAYS

Prior to about twenty years ago there were few, if any, municipal electrical rules or inspectors. As far as the municipal authorities were concerned, owners of buildings could install electric wiring and devices in any manner they chose. The one control that tended to prevent actually hazardous installations was the National Electrical Code, which was prepared for the purpose of protecting fire insurance companies and specified in what manner various kinds of electrical material should be installed in buildings of various classes. Should a builder wish to erect a first-class structure and obtain the lowest rate of insurance, he could install his electrical equipment in accordance with the requirements of this code. Should he desire to insure himself, however, or carry no insurance at all, it was not incumbent upon him to pay any attention whatever to the code.

This arrangement was, therefore, a commercial one and was satisfactory in so far as it went. It satisfied the builders because it gave them definite standards to follow in their construction; it also satisfied the insurance companies because it protected them in their risks; it satisfied the electrical industry because it gave definite information on which to base commercial operations. It did not, however, entirely protect the public nor was it intended to do so.

In the first decade of the present century a radical change took place in the situation. The "safety first" movement swept over the country at this time, workmen's compensation laws were enacted by many states, and a large number of municipalities passed ordinances regulating the installation of electric wiring and appliances to be used in buildings within their jurisdiction and appointed inspectors to see that the regulations were complied with.

Under these conditions the building owner was no longer at liberty to install electrical equipment as he pleased. The police power of the municipality now dictated to him in the interest of the public safety as to what he must and what he must not do. The spirit behind these regulations is entirely laudable. It represents an effort to save many lives and reduce the country's casualty and fire losses. No one not thoroughly mercenary can possibly object to the principle involved.

As carried out in practice, however, the result is by no means satisfactory. In place of the one recognized electrical code which had previously guided the builder, contractor, electrical manufacturer and public utility, a large number of codes came into existence, each with police power behind it and each liable to many different interpretations, depending upon state and local law, the personality of the inspectors and the local political situation.

Under these conditions it is inevitable that certain localities should have established regulations that are too rigid and demand the use of unnecessarily expensive electrical materials. On the other hand, the regulations in certain other localities are not rigid enough, permitting the use of inferior and hazardous construction and giving insufficient protection to the public. In other instances unessential variations are required; for example, one state requires that inclosed safety switches must have covers hinged at the top, another requires covers hinged at the

WHAT LIES BEHIND THE CODES IN THE UNIFORM ELECTRICAL ORDINANCE

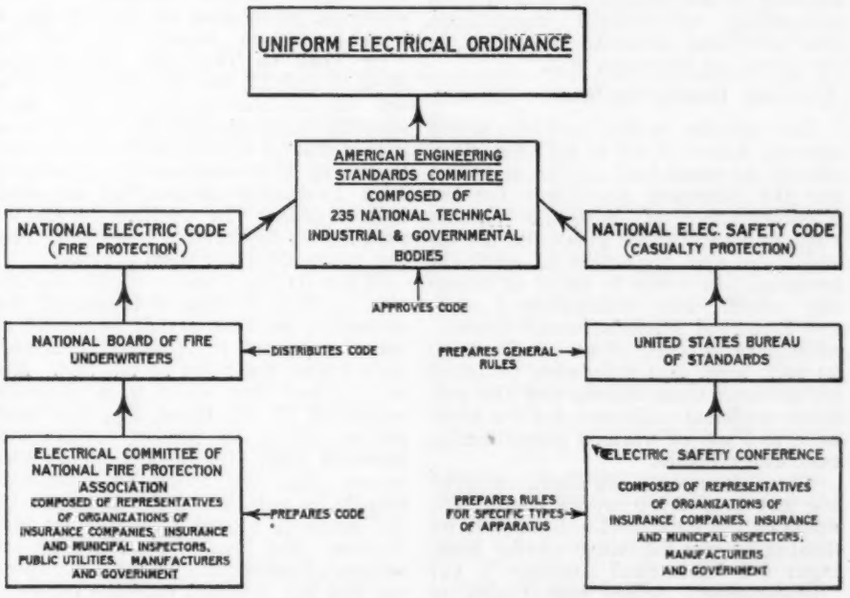

UNIFORM ELECTRICAL ORDINANCE
AMERICAN ENGINEERING STANDARDS COMMITTEE
COMPOSED OF 235 NATIONAL TECHNICAL INDUSTRIAL & GOVERNMENTAL BODIES
NATIONAL ELECTRIC CODE (FIRE PROTECTION)
NATIONAL ELEC. SAFETY CODE (CASUALTY PROTECTION)
APPROVES CODE
NATIONAL BOARD OF FIRE UNDERWRITERS
DISTRIBUTES CODE
PREPARES GENERAL RULES
UNITED STATES BUREAU OF STANDARDS
ELECTRICAL COMMITTEE OF NATIONAL FIRE PROTECTION ASSOCIATION
COMPOSED OF REPRESENTATIVES OF ORGANIZATIONS OF INSURANCE COMPANIES, INSURANCE AND MUNICIPAL INSPECTORS, PUBLIC UTILITIES, MANUFACTURERS AND GOVERNMENT
PREPARES CODE
PREPARES RULES FOR SPECIFIC TYPES OF APPARATUS
ELECTRIC SAFETY CONFERENCE
COMPOSED OF REPRESENTATIVES OF ORGANIZATIONS OF INSURANCE COMPANIES, INSURANCE AND MUNICIPAL INSPECTORS, MANUFACTURERS AND GOVERNMENT

CHART OF THE PROCEDURE WHICH HAS BEEN FOLLOWED IN THE DEVELOPMENT OF THE UNIFORM ELECTRICAL ORDINANCE WHICH HAS ALSO BEEN CARRIED TO ALL THE INTERESTED ASSOCIATIONS OF THE ELECTRICAL INDUSTRY FOR INDORSEMENT

side, while still another prohibits hinges of any kind and demands that the covers be screwed on. Because of this multiplicity of ordinances, with their varying rules and regulations, the public in many localities must either pay higher prices, obtain inferior protection or receive poor service, and in some cases all three of these disadvantages must be endured.

MENACE TO THE INDUSTRY

The electrical industry as a whole is even more seriously affected. It is an established principle that through quantity production of standardized articles the highest quality appliances can be produced, delivered and installed at the lowest cost. Therefore, if the various types of electrical material can be standardized and sold to a nation-wide market, the best possible results will accrue to the consumer, public utility, contractor, dealer, jobber and manufacturer. Under present conditions, however, it is well-nigh impossible to standardize materials in many electrical lines, and it is necessary to produce many excess and duplicating types and sizes of equipment.

The present situation is bad enough, but it is rapidly growing worse. The inevitable result will be the destruction of nation-wide business in a number of electrical lines and the creation of numerous manufacturers who would serve only their local markets. This would hamper electrical development, because few, if any, of these localized manufacturers could afford the experimental and development work essential to electrical progress. It would also raise prices because of limited production and restriction of competition.

Outside of possibly a few who see profit to themselves in this unnecessary complication, there is no defender of this hamstringing of electrical development. On the contrary, there is a practical unanimity of opinion both on the part of the public and the electrical industry as a whole that uniform electric installation standards should be adopted by all regulatory bodies, thus permitting unrestricted competition and providing adequate protection to the public at minimum cost.

UNIFORM ORDINANCE SIMPLE REMEDY

The solution to this problem is the general adoption of a uniform state statute or municipal ordinance covering the necessary provisions for the administration of adequate specific rules and regulations governing the installation and inspection of electrical material. In order to assist in bringing about this much-desired end, the Electrical Manufacturers' Council, after careful study of all conditions to be met, legal and otherwise, prepared its uniform state statute and the uniform electrical ordinance for the guidance and use of various governmental regulatory bodies.

These documents are short, comprising not over 2,000 words each. The scope of the municipal ordinance is indicated by the following section headings: (1) "Electrical Inspector"; (2) "Appointment, Salary and Duties of Electrical Inspector"; (3) "Right of Access to Buildings"; (4) "Permits"; (5) "Inspection"; (6) "Reinspection"; (7) "Construction Requirements"; (8) "Records of Permits and Inspections"; (9) "Review"; (10) "Penalty"; (11) "Repeal of Conflicting Ordinances"; (12) "Enforcement"; (13) "Responsibility of Owner." In addition, there is an optional section which can be used when deemed advisable and which provides for the licensing of electricians.

The heart of the ordinance is Section No. 7, entitled "Construction Requirements," which states that "No certificate of inspection shall be issued unless the electric light, power and heating installations are in strict conformity with the provisions of this ordinance, the statutes of the state of ....., the rules and regulations issued by the industrial commission of ....., under authority of the state statutes, and unless they are in conformity with the most approved methods of construction for safety to life and property. The regulations as laid down in the National Electrical Code, as approved by the American Engineering Standards Committee, and in the National Electrical Safety Code, as approved by the American Engineering Standards Committee, and other installation and safety regulations approved by the American Engineering Standards Committee shall be prima facie evidence of such most approved methods."

It will be seen that this clause has been very carefully worded so that the power of the state or municipality to control its own rules and regulations has not been interfered with, but the regulations as laid down in the codes referred to are made "prima facie" evidence of the most approved methods and thereby gain the legal and moral support of the states and municipalities. Rules under the codes required by purely local conditions are not prevented.

ORIGIN OF CODES

A word as to these codes. The National Electrical Code, which covers fire protection, was drawn up by the electrical committee of the National Fire Protection Association and promulgated by the National Board of Fire Underwriters. The National Electrical Safety Code, which covers casualty protection, is the work of the United States Bureau of Standards and the Electric Safety Conference. Both codes were nationalized owing to their being prepared in accordance with the procedure necessary to receive the approval of the American Engineering Standards Committee. It is the unique national character of these codes and the thought and experience lying behind them that give the uniform electrical ordinance its great value and make it worthy of acceptance by all municipalities.

The work of presenting this ordinance to the municipalities of the country has encountered marked success, as it meets the requirements of regulatory bodies and assures stability of administration to the builder, contractor, public utility and electrical manufacturer by providing for uniform methods of installation. In addition, it assures the public of receiving adequate protection to life and property at minimum cost.

Committee Adopts New Wiring Rules

W. H. Blood's Proposed Rules for Non-Metallic Sheathed Cable Approved with Slight Changes—Smaller than No. 18 Wire in Cords Recognized by Code

AMONG various changes made in the National Electrical Code at the regular annual meeting of the electrical committee of the National Fire Protection Association, held in New York on Thursday and Friday, Feb. 18 and 19, was the adoption of a set of installation rules for non-metallic sheathed cable for inclusion as a new section of Article 5 of the code. Secretary Wentworth of the American Fire Protection Association attended both sessions. In addition to Chairman Small, 35 out of a possible 39 voting representatives were present.

When Article 5 came up for discussion A. Penn Denton, chairman of the committee on that article presented a set of proposed installation rules and moved that the rules be adopted. Attention was then given to a minority report of W. H. Blood, Jr., who was absent owing to illness. Alexander Maxwell read Mr. Blood's report and moved that the rules as contained therein be substituted for the rules in the majority report presented by Mr. Denton. Mr. Denton read a personal statement supporting the majority opinion and Mr. Maxwell read the personal statement of Mr. Blood supporting the minority opinion. The chairman of the electrical committee reported the receipt of more than thirty signed communications from inspectors, recording a favorable impression in the use of "Romex," a type of non-metallic sheathed cable made by the Rome Wire Company, Rome, N. Y.

Chairman Small also reported the receipt of two communications from H. T. Dyett, president of the Rome Wire Company. One of the communications was an emphatic protest against the adoption of rules for non-metallic sheathed cables as proposed by the Article 5 committee's report of Nov. 18, 1925, or of rules embodying the substance of such proposal. The other communication supported the company's contention that there has been unnecessary delay in making a decision as to whether "Romex" should be admitted to the code or not and was a chronological history of the efforts of the Rome Wire Company to obtain recognition for non-metallic sheathed cable. The committee was also informed of the support of Mr. Blood's report by a member, H. N. Pye, who was absent. After a discussion the motion to substitute the minority report was passed by a vote of 24 to 11.

In acting upon the proposed installation rules of the minority report the committee noted that the text was not

in accord with editorial form, and the chairman of the electrical committee was endowed with power to revise the text to meet the editorial form required by the code. Some of the proposed rules were approved and some amended. The chairman of the electrical committee was instructed to revise paragraph g, with the subparagraphs 1, 2 and 3, eliminating the phrase "as on sidewalls" and then having the entire sense of the paragraph include provisions having the sense of paragraphs m, n, o, and s of Section 501 of the code included in the paragraph g.

Approved Installation Rules

The following are the rules for nonmetallic sheathed cable that have been approved by the committee. These are the rules as submitted by Mr. Blood with the amendments and changes as voted at the meeting, but before the editorial revision which Chairman Small was empowered to make:

a. Shall be of approved make.
b. May be used on circuits where the maximum difference in potential between any two wires does not exceed 300 volts; in sizes from No. 14 to No. 8 inclusive and in two and three-wire assemblies.
c. May be used in dry places only and shall not be permitted in stables, laundries, chemical works or other places where dampness is liable to accumulate. It shall not be laid in plaster, cement or similar finish.
d. May be run without insulating supports or separators, exposed on woodwork, plaster, cement or brick where these surfaces are always dry. Shall be supported by approved fastening devices spaced not farther than 4 ft. apart.
e. May be used in concealed work and may be fished without supports from outlet to outlet.
f. Shall be run in continuous lengths without taps or splices from outlet to outlet.
g. Shall be suitably protected where subject to mechanical injury, by one of the following methods:
(1) By running boards not less than ½ in. in thickness and 2 in. in width.
(2) By guard strips not less than ⅞ in. in thickness placed on each side of and close to the cable and at least as high as the thickness of the cable.
(3) By metal pipe or conduit.
(4) When run through timbers must be as near as practicable to the center of horizontal wall studs and not less than 2 in. from the upper edge of floor joists.
h. May be used in approved conduit when the regular installation rules for conduit are followed.
i. Shall be provided with approved outlet boxes or plates to which it shall be securely fastened by approved fittings.
j. Shall be so handled that the outside covering will not be injured.

Some of the electrical committee who were not in agreement with the action of the whole committee requested that the majority report of the Article 5 committee be submitted to the American Engineering Standards Committee as the minority report of the electrical committee.

Rules for Procedure Proposed

An elaborate set of rules for procedure in the committee were proposed and referred to a special committee for report. After a thorough debate it was agreed that items that have passed the controversial stage and been recognized as standard practice should be put in the National Electrical Safety Code. By a unanimous vote no further action will be taken on the proposal of last summer to investigate armored cable.

At the November, 1924, meeting a special committee on the question of interpretations was created. This committee recommended that no action be taken. The recommendation was rejected and the committee was asked to reconsider it. The entire electrical committee agreed to confer with the committee on interpretations to point out the desirability of interpretations.

1926 Edition of Code Discussed

There was some discussion as to the advisability of printing a 1926 edition of the code or a supplement, or in some way officially recording the action of the committee and making it available. A definite decision will be made by the N. F. P. A. To expedite matters dates for the submission of reports of the article committees were set earlier.

Among the important changes made was the adoption of a table of gutter widths for vertical wires of No. 1 size or larger in order to deflect them where they enter or leave a cabinet. The use of auto-transformers on polyphase circuits was referred to a joint committee for study. The sense of the committee recommendations regarding rules with respect to underfloor raceways was adopted. In Article 6 two rules taken together are quite radical as they will permit the use of wire smaller than No. 18. Proper specifications for tinsel cord will be developed and approved by the Underwriters' Laboratories for appropriate use. A companion action regarding fixture wires may come at a later date.

Rule 16 was materially amended and will hereafter apply to all appliances rather than heaters exclusively. Permission to use type C cord has now been restricted.

Admitting New Materials to the Code

Present Delays Handicap Manufacturers —Financial Burden Too Large for Small Company to Bear

IN REFERRING to the delays incident to definite action being taken by the National Board of Fire Underwriters regarding "Romex," H. T. Dyett, president of the Rome Wire Company, in an address before the Article 5 committee at its recent meeting in Chicago, declared that the men of the industry should use their best effort to change the present procedure in the interests of justice to the individual and the small manufacturers. A report of the meeting of the Article 5 committee appeared in the Jan. 30 issue of the ELECTRICAL WORLD (page 277).

Mr. Dyett in his address said: "I know of no industry but the electrical industry where so many eminent men of large affairs give so unselfishly so much of their valuable time to the many involved committee meetings apparently necessary in the present intricate method of procedure. Three and one-half years ago an idea was brought to me which I then believed, and still believe, was a distinct advance in the art of secondary wiring. Since that time our case has been in the hands of various committees for months at a time. At least eight exhaustive series of expensive laboratory tests have been run in addition to countless tests in our own laboratories. Each of these tests has served to strengthen my confidence that the material is an improvement in the secondary wiring art.

"We have been to large expense in research, labor, testing, expert advice, legal talent, traveling expense, printing and the presentation of our case. This has been no light financial burden and could ill be borne by a small company. I believe some of the best talent in the industry is to be found among some of the small individual companies. Are these companies to be denied the opportunity to solve some of the important problems of our industry? Are we to continue this complex procedure so unfair to the smaller manufacturer? Shall control of the development of the industry be taken out of the hands of the industry at large and left in the hands of the financially strong? The eyes of the industry are focused upon the procedure in this particular case. Is the outcome to be a fair one that will bring confidence in its ultimate verdict, or is the smaller manufacturer to believe that the only avenue of escape lies in recourse to legal procedure?"

Business Conditions

PURCHASING by central-station companies, with exceptions in some sections, is not in large volume. Manufacturers report the receipt of many inquiries from such companies, however, particularly for paper-cable and substation apparatus. Industrial business is very active, many small orders are reported in the New York district, and lumber and irrigation companies are active on the Pacific Coast. Electrical men believe that good sales will continue and are optimistic.

A motor manufacturer reports a large increase in the number of orders for synchronous motors in sizes from 60 hp. to 100 hp., as well as an increased number of orders for special equipment. This company states that while it operated at only 40 per cent capacity last year, it is now operating at 60 per cent capacity with prospects of a further increase. This manufacturer has noticed that the betterment of industrial conditions has resulted in an inclination toward a stiffening of quotations. Electric range campaigns are being planned by central-station companies in the Southwest and Pacific Coast, and the quotas set are high, so that an active business is anticipated in this line.

In New England sales are in steady volume, and many inquiries are being received for power equipment. A northern Vermont plant has just purchased a 5,000 kw. hydro-electric generator and other station apparatus and supplies amounting to about $750,000.

Many inquiries are being placed by central-station companies in the New York district. Holding companies for Southern and Western properties continue active, one manufacturer re-

ceiving an order from such a company for about $400,000 worth of turbo-generating equipment. In the Southeast good business in virtually all lines is reported, line construction materials are in demand and industrial business is quite active. The volume of business in the Middle West is gradually increasing, but utility company buying is comparatively light. Inquiries for considerable quantities of paper-insulated cable have been placed with manufacturers. On the Pacific Coast buying by railroad companies is active and irrigation business and lumber company buying are in large volume.

Non-Ferrous Metal Markets Continue Dull

Little life has been exhibited by any of the non-ferrous metal markets during the past week. The volume of business has been small and copper and lead prices are a trifle lower. The volume of domestic copper business is still small, though sales last week were considerably better than in the preceding one.

NEW YORK METAL MARKET PRICES

	Feb. 17, 1926 Cents per Pound	Feb. 24, 1926 Cents per Pound
Copper, electrolytic	14.275	14¼
Lead, Am. S. & R. price	9.15	9.15
Antimony	21¼	21¼
Nickel, ingot	35	35
Zinc, spot	7.90	8.10
Tin, Straits	64¼	64¼
Aluminum, 99 per cent	28	28

Base copper price Feb. 24, 1926, 16 cents

Only a small accumulation of orders came to lead producers on Tuesday. The official price of the American Smelting & Refining Company continues at 9.15 cents, and that level has been realized on a few small sales of spot metal and on a little business booked in the East by Middle Western producers. Lead consumption continues excellent in the United States, especially with the battery and cable makers, but it is not so satisfactory in Europe. Zinc appears to have recovered from the slump that took it to 7.40 cents to 7.45 cents last Thursday, excellent sales being made on Saturday and on Tuesday at 7.70 cents and 7.75 cents. Consuming inquiry is not much in evidence, galvanizers being particularly reluctant to place orders. The tin market has been dull all week, consumers showing little interest at the present level of prices except for urgent current requirements.

Industrial Business Active in Southeast

Good business in virtually all lines is reported in the Southeast particular activity being noticeable in line construction materials. Orders are being received from large as well as the small central-station companies and municipalities. Telephone-line construction materials, except for Florida orders, are somewhat quiet. Steam railroads are buying moderately of line materials used principally in the construction and the installation of block signal systems.

Industrial business is quite active, both as regards orders and inquiries. Good orders are reported for small motors for individually driven textile machines, and textile-mill electrification contracts recently let and pending indicate a sustained volume of motor business for months to come. Turbine sales are good, one manufacturer stating that his company recently received orders for three units with a total capacity of 42,500 kw. Central-station appliance sales are in good volume, and most of the larger companies have ambitious sales programs planned for the spring. All jobbers report their appliance sales above the average for this period, and one manufacturer states that his business has exceeded by more than 75 per cent the sales of ranges and appliances during the same period of 1925. There is a general increase in the sale of electric water heaters, the activity being particularly noticeable in Florida. The larger central-station companies are planning to launch range sales campaigns in April and May.

Volume of Business in Middle West Gradually Increasing

The volume of business in the Middle West is gradually increasing and the general tone of the electrical industry is optimistic. Commodity prices are stable and money rates are steady. Production is on a high level and credits are ample for commercial needs. The various utility companies are quietly marking time, although maintenance purchases are quite large and tend materially to increase the volume of business. Some construction work is being started, and there has been a normal demand for distribution equipment. Tentative inquiries for considerable quantities of paper-insulated cable are being issued at this time. Jobbers' sales continue satisfactory, the active building programs resulting in considerable business. The demand for motors has been quite heavy, one jobber receiving an individual order totaling over $20,000. There has been an active demand for industrial lighting equipment.

Sales in New England District in Steady Volume

Sales throughout the New England district have been steady with an increased interest in power equipment. A 5,000-kw. hydro-electric generator unit and station construction supplies amounting to about $750,000 has been contracted for by a northern Vermont company. Transformer sales have been more active, and a prominent manufacturer reports the receipt of a number of large orders and many inquiries. Voltage-regulator sales also show an encouraging increase.

Industrial electric heating installations are less active at the present time, though interest in this field is very keen; on the other hand, one manufacturer states that conditions in the Middle West are encouraging and reports receiving one order for $10,000. The machine-tool industry is awakening to the advantages of electrification and many negotiations regarding heating applications and motor drive are being received. Paper mills are also considering plant additions and changes, and one large concern in Maine has extensive alterations under consideration. Small motor sales are steady, street-lighting plans are maturing, and household appliance sales are spotty.

Railroad Buying Particularly Active on the Pacific Coast

Railroad buying has been particularly active on the Pacific Coast and includes 20,000 glass insulators, 50,000 ft. ¾-in. Siemens-Martin strand, etc. Power-company buying is somewhat quieter and includes purchases of 150 line switches, construction tools, 5,000 ft. 1¼-in. galvanized conduit and other distribution-line construction material. Dealers' inquiries include one for 500 fans for the Fresno district. The Pacific Gas & Electric Company is inaugurating a new range campaign with a quota of 5,000 set for 1926. A conservative estimate of the sale of ranges in California during 1926 is 8,000. Irrigation business and lumber-company buying, the latter especially in the Eureka district, are good. Two 54,000-hp. waterwheels for installation in that district have just been purchased.

Inquiries for electrification equipment for sawmills continue, one company asking quotations on 40 motors ranging from 10 hp. to 250 hp., and, in addition, many small sales are reported. The State of Washington faces a serious shortage of water for the operation of hydro-electric plants and for irrigation during the summer owing to the snow reserves in the mountains being far below normal.

Many Inquiries Placed by Central Stations in New York District

A decidedly optimistic spirit is apparent in the New York district, despite the fact that no marked improvement in central-station buying has as yet been manifest. Inquiries for estimating purposes are still being received from this source, and it is expected that an order from one company for transformers and associated apparatus for substation use, totaling approximately $200,000, will be placed in the near future. Holding companies for Southern and Western properties continue active, one manufacturer reporting that an order from this source for about $400,000 worth of turbo-generating equipment was placed recently. Other manufacturers of transmission-line and switching equipment also report a considerable volume of prospective orders for their materials among this group.

The industrial market continues strong, with a steadily increasing demand for motors of the smaller sizes, such as are required by the clothing trades. There is also an increase reported in the sales of motors for refrigerating machinery, one manufacturer stating that he has recently received several orders averaging around $4,000 to $5,000 each. A manufacturer of safety switches reports that sales up to the middle of February have been better than in any previous year. Jobbers report domestic conditions unchanged, and in one case an active export market was recorded in South America and Mexico.

Activities of the Trade

Simplex Keeps Open House in High-Tension Laboratory

Nearly 300 members and guests of the Boston Section, A.I.E.E., were entertained by the Simplex Wire & Cable Company, Feb. 19, at the Cambridge (Mass.) factories of that organization in connection with a meeting on cable testing and an inspection of the high-tension laboratory lately placed in service by this manufacturer. Following a dinner in one of the company's new buildings, at which President Everett Morss was host, F. M. Farmer, chief engineer of the Electrical Testing Laboratories, New York, read an illustrated paper on "Modern Cable Testing." The meeting then adjourned to the new laboratory, where several high-voltage demonstrations were made with potentials up to about 750 kv., including flashovers of wet and dry insulator strings and single-phase and three-phase spark gaps.

The new laboratory occupies two buildings, one with 3,000 sq.ft. of floor area for high-voltage work and the other with 5,000 sq.ft. for lower potential investigations and tests. It is fully equipped with transformer, motor-generator, control, measuring and auxiliary apparatus for conducting both commercial tests and research, and at the meeting Mr. Morss stated that its resources are available under reasonable supervision to educational institutions and to the engineering industry as the company's contribution to investigation in high-tension phenomena. Dr. A. E. Kennelly, Harvard University, and Profs. D. C. Jackson and V. Bush of the Massachusetts Institute of Technology expressed their appreciation of the laboratory and of the Simplex company's policy in connection with its utilization.

Coldak Corporation Issues Stock and Will Expand Production

The Coldak Corporation, which manufactures and sells automatic electrical refrigerating machines for domestic and commercial uses under the trade name "Coldak," has issued 360,000 shares of class A stock for the purpose of acquiring the assets owned, used and controlled by the Multicold Company, for which 47,500 shares have been set aside, and to furnish the Coldak Corporation with additional capital to provide for an increased production to meet the growing demand. The corporation will be under the administration and direct supervision of the J. G. White Management Corporation, managers of public utilities and industrial plants, and John H. Pardee, its president, is president and chairman of the board of the Coldak Corporation.

In addition to Mr. Pardee the board of directors will include the following: J. I. Mange, president of the Associated Gas & Electric Company; R. P. Stevens, president of the Republic Railway & Light Company; C. M. Burnhome, vice-president of the Coldak Corporation; A. P. de Saas, president of the Radiant Heat Corporation; R. A. Pritchard, attorney; Hazor J. Smith, treasurer of the Multicold Company; Willard Reid, president of the Multicold Company, and Lowell Mason, of De Ridder, Mason & Minton.

Westinghouse Gets Orders for Large Electric Locomotives

All the motive machinery, controls and other electrical equipment for six large electric passenger locomotives and two double-cab switching locomotives have been awarded by the Pennsylvania Railroad to the Westinghouse Electric & Manufacturing Company. The six passenger locomotives with a continuous rating of 3,730 hp. each, which, it is said, will compare as regards both tractive effort and speed with the greatest steam locomotives in existence, will be put into operation on the New York division hauling heavy passenger trains between the Pennsylvania Terminal in New York City and Manhattan Transfer. These locomotives are in addition to two others of a similar type placed in service at Manhattan Transfer in 1924. Each of the passenger locomotives will weigh approximately 400,000 lb. with a total length of 68 ft.

The National Electric Manufacturing Company, Chatfield-Woods Building, Pittsburgh, announces a change in its name to the Syntron Company. The company manufactures the Syntron electric hammer.

The Copeland Products Company, Flint, Mich., manufacturer of electric referigerators, announces through E. S. Barber, general sales manager, that the production of Copeland machines in December averaged about 43 per working day and the maximum production was 65 machines. Plans for 1926 contemplate an average production of 100 machines per day, said Mr. Barber. The company has recently expanded its resources through the operation of a new capital issue, as announced in the Feb. 20 issue of the ELECTRICAL WORLD.

The American Engineering Company, Philadelphia, has received an order from the Detroit Edison Company for six Taylor underfeed stokers for a new addition to its Marysville power generating station. These stokers will fire three boilers with 28,210 sq.ft. of heating surface each, or a total of 8,463 boiler-hp.

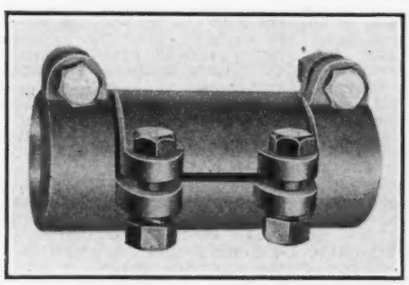
The Standard Electric Stove Company, Toledo, Ohio, announces that automatic oven control is now available for four models of its ranges.

The Benjamin Electric Manufacturing Company, Chicago, manufacturer of industrial lighting equipment, etc., held a three-day sales and advertising conference at its main office at Chicago early this month. Sales plans, including an extensive advertising program, were developed and approved.

New Equipment Available

One-Piece Clamp-Type Straight Connector

The Burndy clamp-type straight connector has been placed on the market as an addition to its line of connectors by the Burndy Engineering Company,



ONE-PIECE CLAMP-TYPE CONNECTOR

10 East Forty-third Street, New York. This connector, as shown in the illustration, is of one-piece construction and is said to retain the full strength of the solid tube. Pressure is applied in two right-angle planes at four areas, giving 100 per cent conductivity. Tobin bronze bolts and copper-plated steel-lock washers are used, and the body of the connector is of a high conductivity copper alloy. The connectors are available in all sizes up to 3-in. iron-pipe.

Wattmeters for Measuring Dielectric Losses in Cable

Two portable wattmeters, for measuring dielectric losses of cable in reel lengths, have lately been developed by the Rawson Electrical Instrument Company, Cambridge, Mass., and the General Electric Company. The development took place with the co-operation of the Simplex Wire & Cable Company, Boston. By making suitable corrections it is stated that tests can be made by one man in five minutes each, compared with a requirement of three men and an hour's work with the bridge method applied to a 10-ft. section only. These instruments read in fractional watts, 0.4-watt and 0.8-watt maximum, and have narrow-phase angles in their potential circuits at 60 cycles.

The Rawson instrument is of the single-pivot dynamometer type with no damping, one current range and two voltage ranges, designed to give maximum scale readings of 0.2 watt and 0.4 watt with current under 0.2 amp. and voltages below 100 and 200 on the respective ranges. The phase angle of the potential circuit at 60 cycles is 4 min. 24 sec. to 2 min. 12 sec. The General Electric instrument is rated at 0.1-0.2 amp., 50/100 volts and 0.2/0.4/0.8 watt. The phase angle of the potential circuit at 60 cycles is 5 min. 33 sec. to 2 min. 48 sec.

New Trade Literature

WIRE-TESTING APPARATUS. — The Morehouse Machine Company, York, Pa., is distributing a folder which describes and illustrates its apparatus for testing the springiness of magnet wire such as is used for winding armatures and field coils.

PUMPS.—Bulletin No. 24 issued by the Pelton Water Wheel Company, 2929 Nineteenth Street, San Francisco, describes and illustrates the Pelton types "DS" and "ST" pumps. Illustrations are given showing various applications of these pumps. Tables of friction of water in pipes and curves showing maximum practical suction lifts are included.

MANUAL CONTROLLERS.—The Clark Controller Company, Cleveland, Ohio, is distributing bulletin No. 100, covering the Clark manual controllers designed for heavy-duty service, suitable for overhead electric traveling cranes, charging machines, mill tables or any application where reversing of the motor is necessary and where hand operation is suitable.

FLEXIBLE BELT DRIVE.—Bulletin No. 1,228-B, issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes the Allis "Texrope" drive. This bulletin contains a simplified method of figuring "Texrope" drives, with table of horsepower ratings and illustrations of new applications of "Texrope" drive.

PORCELAIN INSULATORS.—The Illinois Electric Porcelain Company, Macomb, Ill., has issued catalog No. 102 covering its complete line of porcelain insulators, transformer bushings, wall bushings, bus supports, etc. It contains illustrations showing the process of manufacturing the various types of Illinois insulators, as well as charts showing the electric strength of air, flashover of suspension insulators in strings and other useful data.

ALUMINUM PAINT. — The Aluminum Company of America, Pittsburgh, is distributing a booklet entitled "Aluminum Paint Manual," in which it gives instructions relative to the selection of proper paint, how to prepare and how to use it.

STEAM GENERATOR.—The Combustion Engineering Corporation, Broad Street, New York City, is distributing a pamphlet describing the Combustion steam generator designed for use with pulverized coal. Among the outstanding features described are the small space requirement, simplicity of the boiler, the adaptability to high steam pressures, the saving in upkeep cost, etc. Various illustrations showing the construction of the generator are included.

SWITCHES. — The Square D Company, Detroit, is distributing a folder describing the Square D 40,000 series of switches, designed for installations requiring infrequent operation, such as "disconnects," entrance switches, etc.

COMBUSTION GAS BURNERS.—A condensed catalog printed on both sides of a single sheet of heavy pressboard, with projecting tab, 10 in. x 11⅛ in., to fit the standard letter file, and describing the Mettler entrained combustion gas burners, has been issued by the Lee B. Mettler Company, 406 South Main Street, Los Angeles. The card contains a complete description and dimension drawings of the burners, as applied to cast-iron, horizontal-return tubular and water-tube boilers.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Beirut, Syria (No. 19,199), for electrical household appliances and insulated copper wire.

An agency is desired in Maracaibo, Venezuela (No. 19,205), for electrical household appliances, such as irons, cook stoves, washers, vacuum cleaners and floor-cleaning machines.

An agency is desired in London, England (No. 19,193), for lighting sets, etc.

An agency is desired in Johannesburg, South Africa (No. 19,204), for motors and generators, alternating-current and direct-current transformers, switch gear and oil switches.

Purchase is desired in Amsterdam, Netherlands (No. 19,251), of radio sets and parts.

Purchase or agency is desired in Campbellton, Canada (No. 19,246), for electric domestic refrigerators.

An agency is desired in Havre, France (No. 19,235), for electric washing machines and other household devices.

An agency is desired in Alexandria, Egypt (No. 19,261), for automatic electric player pianos, etc.

Purchase and agency is desired in Santos, Brazil (No. 19,258), for domestic washing machines.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MILLBURY, MASS.—The proposed 110-kv. interconnection line between the Edison Electric Illuminating Company of Boston and the New England Power Company from Millbury to Medway, a distance of 14.7 miles, has been approved by the Massachusetts Department of Public Utilities. The cost of the line is estimated at $432,635.

PROVIDENCE, R. I.—A petition has been filed with the State Legislature by the officials of the United Electric Railways Company asking for authority to incorporate the United Electric Power Company. According to the petition the new company would take over the power house and transmission lines of the railway company and provide power for the electric railways, lighting transmission and manufacturing purposes.

Middle Atlantic States

BUFFALO, N. Y.—The Federal Ice & Coal Company, 761 Kensington Avenue, plans to build an ice manufacturing plant, to cost about $50,000.

GOUVERNEUR, N. Y.—Bids will be received by the Board of Light Commissioners, Municipal Building, until March 18 for installing street-lighting and distribution system. Lewis C. Reynolds, 387 Castle Street, Geneva, is engineer.

GOVERNORS ISLAND, N. Y.—Bids will be received by the Signal Corps, Procurement District, Governors Island, until March 2, for 500 audio frequency transformers (Circular 27); also, until March 5, for eight steel radio masts, 150 ft. (Circular 29).

LA FARGEVILLE, N. Y. — Application has been filed by the La Fargeville Electric Light & Power Company for permission to erect a transmission line from La Fargeville to the Clayton-Alexandria Bay highway to connect with the lines of the Northern New York Utilities, Inc. The company also asks for approval of a franchise granted by the Town Board of Orleans.

NEW ALBION, N. Y. — The Niagara, Lockport & Ontario Power Company, Buffalo, has applied for approval of a franchise to extend its transmission lines and distribution system to serve electricity in the town of New Albion.

NEW YORK, N. Y.—A permit has been granted to the New York Edison Company to erect a substation, at Boston Road and 172nd Street, to cost $150,000. William Whitehill, 709 Sixth Avenue, is architect.

NEW YORK, N. Y.—Bids will be received by the Department of Health, 505 Pearl Street, New York City, until March 1 for installing new equipment, underground system, roadway lighting, additions and alterations for light and power service in the various buildings at Riverside Hospital, North Brothers Island, Bronx.

OGDENSBURG, N. Y.—Plans for the proposed new local paper mill to be erected by the Algonquin Paper Company include a large power plant. General contract for construction of the plant has been awarded to Burns Brothers & Haley, Watertown.

POTSDAM, N. Y.—The Racquette River Paper Company, plans to rebuild its mill, including electric power plant at Hewitsville, recently destroyed by fire with loss of about $100,000.

STATEN ISLAND, N. Y.—Bids will be received by the Superintendent of Lighthouses until March 8, for one power switchboard distributing panel, with switches, etc., for lightship No. 11 (Proposal 21038).

WEST HAVERSTRAW, N. Y.—Bids will be received by the Superintendent of Purchase, Capitol, Albany, until March 4 for construction, heating, sanitary and electric work of girls' solaria, nurses' home, staff quarters and isolation building at the New York State Orthopedic Hospital for Children, West Haverstraw.

NEWARK, N. J.—Plans are under way by the Prudential Insurance Company, Broad and Bank Streets, for extensions in its electric power plant to cost about $30,000. Cass Gilbert, 244 Madison Avenue, New York, is architect.

GRATZ, PA.—The East Penn Electric Company, Pottsville, has secured a franchise to erect transmission lines in this vicinity.

MIFFLINBURG, PA.—The Pennsylvania Power & Light Company, Allentown, which recently acquired the municipal electric plant, plans extensions in transmission lines in this section.

PHILADELPHIA, PA.—Bids will be received by the Delaware River Bridge Joint Commission, Room 806 Widener Building, until March 3 for electrical equipment for the bridge over the Delaware River connecting the Cities of Philadelphia and Camden. The work will include the installation of electric wiring, and equipment for lighting and power on bridge consisting of transformers, lighting fixtures, lamps and two automatic elevators.

BOONSBORO, MD.—The Antietam Electric Light & Power Company plans extensions and improvements in its hydro-electric power station.

REMINGTON, VA.—Improvements are contemplated by the Virginia Northern Power Company, Richmond, for extensions and improvements to its local plant, including increasing the voltage from 400 to 2,300, etc.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until March 11, for one generator, cable, wire, sockets, reflectors, cutouts, resistance units, etc. (Panama Circular 1723).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until March 3, for a quantity of alternating-current voltmeters (Schedule 900-398).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Washington, until March 25, for terminal blocks, reactor choke coils, contact springs, rheostats, switches, transformers, etc. (Proposal C. P. 23000-B-1). Also, at the same time, for ammeters condensers, voltmeters, etc. (Circular 122).

North Atlantic States

ADA, OHIO.—The construction of a new power plant is under consideration by the Ada Power & Light Company to cost about $50,000. The company is also considering purchasing power and building a substation.

AKRON, OHIO—The Firestone Tire & Rubber Company plans to install electric power equipment in its proposed mill addition, to cost $280,000.

ASHTABULA, OHIO—The Public Utilities Committee plans to install additional equipment in the municipal electric power plant.

CLEVELAND, OHIO—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 12 for substation switching equipment for the Division of Light and Power.

CLEVELAND, OHIO—Contracts it is understood, will soon be awarded by the Cleveland Electric Illuminating Company for the construction of a switch house, control house and oil storage building on Clinton Avenue, to cost about $175,000.

GALLIPOLIS, OHIO. — The Pittsburgh Coal Company & Associated Companies, Oliver Building, Pittsburgh, plan to install electric power equipment and mining machinery at its properties in the Pomeroy Bend district, to cost about $250,000.

BOONEVILLE, KY.—A permit has been granted the Kentucky Hydro-Electric Company, Louisville, for its proposed hydro-electric power project on the South Fork of the Kentucky River, to develop 10,000 hp. The cost of project is estimated at $4,500,000, with transmission system.

LOUISVILLE, KY.—Contract for the construction of the government dam on the Ohio River at Louisville to be built in connection with the 135,000-hp. hydro-elec-

tric development at the Falls of the Ohio, has been awarded to the Byllesby Engineering & Management Corporation, Chicago. The dam, which will be a combination navigation and power dam, will have a total length of 1¼ miles. The corporation is also building the power house on this project.

NORTONVILLE, KY. — The Kentucky Electric Power Corporation has engaged the J. G. White Engineering Corporation, 43 Exchange Place, New York City, to design and construct a 5,000-kw. steam-electric plant. It will be equipped with high-pressure boilers, and turbines, and will use pulverized coal.

HAMMOND, IND.—The Roxana Petroleum Company, Arcade Building, St. Louis, contemplates the construction of a power plant at its proposed local oil refinery. The entire project will cost about $8,000,000.

INDIANAPOLIS, IND. — The Early & Daniel Company, Carew Building, Cincinnati, will install electric power equipment at its proposed grain elevator in the Beech Grove section, to cost about $400,000. Bacon & Tislow, 31 West Ohio Street, are architects and engineers.

CASSVILLE, WIS.—Plans have been approved by the Village Board for the installation of ornamental lamps in the business district, to cost about $12,000.

MASON, WIS. — The Municipal Power Corporation, recently organized by W. A. Foshay Company, Minneapolis, has acquired the property of the Mason Light & Power Company. The new owners plan to rebuild the dam and power plant on the White River, from which transmission lines will be erected to serve the towns of Grand View, Drummond and Cable.

MILWAUKEE, WIS.—Plans are being prepared by E. Brielmaier & Sons, architects, 432 Broadway, for a convent, power house and laundry. Owner's name withheld.

POTOSI, WIS.—Plans for the proposed local smelting and refining plant to be erected by the Tennyson Mining Company, include a power plant.

VANDYNE, WIS.—The Town Board has voted in favor of establishing a street-lighting system.

WAUKESHA, WIS. — Plans are under way by the Wisconsin Gas & Electric Company to erect rural transmission lines from North Prairie to Genesee, and also to extend its lines from Springdale to Prospect to supply electricity in the rural districts in that section.

WAUSAU, WIS.—The Wisconsin Valley Electric Company contemplates rebuilding about 25 miles of transmission line between Stevens Point and Mosinee.

WAUWATOSA, WIS.—Plans are being considered by W. L. Coffey, manager of County Institutions, for an addition to central power plant, to cost about $316,000.

WILMOT, WIS. — The Carey Electric Light & Power Company, recently incorporated with a capital stock of $150,000, plans to furnish electricity in Wilmot and Bristol, and also to consumers in adjacent rural communities.

ST. PAUL, MINN.—An ordinance has been approved by the City Council providing for the installation of ornamental lamps on Osceola Avenue, and on Saratoga Avenue, for which bids will soon be asked.

WALTERS, MINN.—Plans are under way by the City Council for the installation of an electric light and power system, for which bonds have been issued. Electricity will be supplied by the Interstate Power Company, Chicago.

ATLANTIC, IOWA—Bids will soon be asked by the City Council for water-softening equipment for the municipal light and power plant.

CENTERVILLE, IOWA. — The Iowa Southern Utilities Company contemplates improvements to its transmission line between Centerville and Leon.

IDA GROVE, IOWA—The Iowa Light & Power Company, Carroll, has applied for permission to erect a high-tension transmission line to connect Ida Grove with the Cherokee high-tension line and extending east and west to Holstein and Galva, covering a distance of about 17 miles.

MASON CITY, IOWA—Plans are under way by the United Light & Power Company, Grand Rapids, Mich., for doubling the output of its local power plant, to cost $100,000.

SIOUX CITY, IOWA.—The City Council is considering the installation of an improved fire alarm system, to cost about $50,000.

SUGAR CREEK, MO. — The Jackson County Light, Heat & Power Company, Independence, has been granted a franchise to furnish electric service here.

Southern States

NEW BERN, N. C.—Plans are being considered by the Neuse River Electric Company to extend its transmission lines to Fort Barnwell and Dover, and also to erect a line to Vanceboro and one into Palmico County. The cost is estimated at $25,000.

ROSEBORO, N. C.—The Roseboro Mills, Inc., will build a steam-electric power plant at its proposed local textile mill. The entire project will cost $150,000.

ROCK HILL, S. C.—Plans are under way for the installation of ornamental lamps in the downtown district. W. P. Goodman is city manager.

LOUISVILLE, GA.—The Georgia Southern Power Company, which recently acquired the municipal electric plant, plans extensions in transmission lines in this section.

THOMASVILLE, GA.—Bids will be received by the Department of Water and Light, until March 8, for one 1,250-kva. turbo-generator and surface condenser. D. R. Pringle is superintendent.

BOYNTON, FLA.—The City Council is arranging a bond issue for municipal improvements, including the installation of an improved street-lighting system in the downtown district.

GAINESVILLE, FLA.—The City Council has authorized a bond issue of $585,000, part of the proceeds to be used for extensions and improvements in the municipal electric light and water plant.

JACKSONVILLE, FLA.—The Board of Public Utility Commissioners is considering a bond issue of $2,000,000, for extensions and improvements in the municipal electric light and power plant to increase the capacity by about 30,000 kw.

SANFORD, FLA.—A special election will be held on March 19, to vote on a proposal to issue $75,000 in bonds, the proceeds to be used for extensions in the ornamental street-lighting system.

SEBRING, FLA. — The Lake Glenada Woodlands Development Company is considering the installation of ornamental lamps on the highway between Sebring and Avon Park.

CLARKSVILLE, TENN.—The City Council is considering plans for the installation of an ornamental lighting system in the downtown district.

COWAN, TENN.—The Cumberland Portland Cement Company, care of Davidson, Hicks & Greene, 100 Russell Street, Nashville, now being organized, plans to build a power plant at its proposed local cement mill. The cost of the entire project is estimated at $1,200,000.

FAYETTEVILLE, TENN.—The Southern Cities Power Company, Chattanooga, which has acquired the local electric system, plans to convert the local plant for substation, and to extend its transmission lines in this section.

CRICHTON, ALA.—The Mobile Paper Mills, Inc., Mobile, plan to install electric power equipment at its proposed local boxboard mill, to cost about $500,000.

NEWPORT, ARK.—The installation of a 1,500-hp. generating unit at its local plant, to cost about $14,000, is under consideration by the Arkansas Light & Power Company, Pine Bluff. R. E. Burton, Little Rock, is engineer.

OBERLIN, LA.—The City Council has granted a franchise to the Louisiana Public Utilities Company, Inc., New Orleans, to supply electricity here. A transmission line will be erected from the plant at Oakdale to furnish the service.

RIPLEY, OKLA.—The Oklahoma Gas & Electric Company, Oklahoma City, plans to erect a transmission line in this section for local service, and also to Manville.

TAHEQUAH, OKLA. — Permission has been granted to Charles Page, president of the Sand Springs Light & Power Company, to build a hydro-electric plant on the Illinois River, to cost about $690,000. C. Tingley, Sand Springs, is engineer.

GRAYBURG, TEX.—The Western Public Service Company, Colorado Springs, Colo., is planning to erect a transmission line from Sour Lake. Extensions and improvements will be made in other lines in this district.

QUINLAN, TEX.—Plans are under way by H. E. Hobson, Quinlan, and associates for the construction of a local electric power plant for commercial service, to cost $25,000, with transmission line.

PECOS, TEX.—Extensions and improvements are contemplated by the Continental Gas, Power & Light Company, Fort Worth, which recently acquired the local plant, including the installation of new equipment, the erection of a high-tension transmission line to Barstow and the shallow water irrigation district.

SANDERSON, TEX. — The Continental Gas, Light & Power Company, Fort Worth, which recently acquired the local plant, contemplates improvements to the system.

TEXAS CITY, TEX.—The City Commission has appropriated $10,000, for the installation of an ornamental lighting system on Sixth Street.

Pacific and Mountain States

SCENIC, WASH.—The Great Northern Railway Company, St. Paul, has applied for permission tentative to build a hydro-electric power development on the Foss River, near Scenic, with initial capacity of 35,000 hp., to be used in connection with the proposed electrification of its lines in this vicinity.

STANWOOD, WASH.—The Puget Sound Power & Light Company plans to erect a transmission line to Milltown, and also a line from East Stanwood to Silvans.

HOOD RIVER, ORE. — Electric power equipment will be installed in the proposed ice and cold storage building to be erected here by Maynard & Child, Railway Exchange Building, Portland, to cost $115,000.

HERMOSA BEACH, CAL.—The Board of City Trustees is planning to install ornamental lamps on Hermosa Avenue, from Pier Avenue to the city limits, and on Manhattan Avenue, using concrete standards.

CULVER CITY, CAL.—The City Council is considering the installation of ornamental lamps on portions of Fay, McManus, Halm, Caroline, Cattaraugus and other streets.

SONORA, CAL. — The City Council is planning the installation of an electric fire-alarm system.

WALNUT CREEK, CAL.—Plans have been prepared by the Pacific Gas & Electric Company, San Francisco, for a substation, near Orinda, to cost $50,000.

BOISE, IDAHO—The City Council plans to install ornamental lamps on South Eighth Streets, to cost about $10,000.

PAYSON, ARIZ. — A. Grady Harrison, Payson, has applied for a franchise to construct a steam-electric power plant in Payson.

HELENA, MONT.—The American Smelting & Refining Company, 120 Broadway, New York, plans to install electric power equipment in connection with extensions to its lead smelter, to cost about $125,000.

Canada

DIGBY, N. S.—Plans have been prepared by W. L. Snooks, electrical contractor, St. John, N. B., for a hydro-electric development at the Upper Falls on the Sissiboo River, where it is estimated that 200 hp. can be developed. The cost, not including power house, is estimated at about $40,000. H. H. Marshall is chairman of the committee appointed to investigate the matter.

FORT FRANCES, ONT.—Contract has been awarded by Backus-Brooks Company, Minneapolis, for the erection of a 110,000-volt transmission line from the Seine River to Fort Frances, on the Rainy River, 110 miles long, to supply electricity to the mill of the Fort Frances Pulp & Paper Company and to towns along the line. The cost of the line is estimated at $750,000. Other developments of the company in Canada include a power plant on the Winnipeg River producing 17,000 hp., expansion of the manufacturing plant at Kenova, Ontario, and at its properties in Fort Frances and International Falls.

KAPUSKASING, ONT.—Plans are being prepared by the Spruce Falls Pulp & Paper Company, for a 400-500 ton newsprint mill in Kapuskasing and a hydro-electric power plant on the Mattagami River at Smoky Falls, to cost about $10,000,000. G. F. Hardy, 305 Broadway, New York City, is engineer.

THOROLD, ONT.—The Public Utilities Commission is considering increasing the generating capacity of the municipal electric power plant.

QUEBEC, QUE.—Plans are being considered by the Quebec Power Company to increase the capacity of its workshops at Limoilou, and also to complete certain works on its lines, involving an expenditure of about $400,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 19, 1926)

1,570,447. ELECTRIC TOASTER; M. Murphy, Rushville, Ind. App. filed June 16, 1925.

1,570,499. RADIO BATTERY-CHARGING SWITCH MEANS; J. F. Keane, Bridgeport, Conn. App. filed Feb. 28, 1924. A control switch permanently connecting a radio set, storage "A" and "B" batteries, and a charger, to the end that, through manipulation of the switch, either of the batteries may be charged, as desired, or the set may be operatively connected.

1,570,505. ELECTRIC TELEMOTOR APPARATUS; M. P. Laughlin, Bath, Me. App. filed March 2, 1922. For enabling a moving part to be effectively controlled from a distance, and aims to provide means in which the control may be effected by the use of a circuit or circuits which shall be free from contacts or circuit making and breaking devices.

1,570,507. ELECTRIC APPLIANCE; E. N. Lightfoot, New York, N. Y. App. filed Sept. 21, 1921. Employing a heater which may be of the so-called immersion type, arranged to be automatically de-energized when not in use.

1,570,597. LIGHTING FIXTURE; F. C. De Reamer, Bridgeport, Conn. App. filed Nov. 11, 1922. Of the "Elexit" type with means for preventing injury to wall-paper, etc., when removing a fixture.

(Issued Jan. 26, 1926)

1,570,655. ELECTRICAL SWITCH; C. E. Warner, Berwin, Ill. App. filed Nov. 24, 1919. Pull-switch socket in which the circuit is simultaneously broken at two points.

1,570,670. ELECTRIC WATER HEATER; M. J. Horswill, Oakland, Cal. App. filed March 5, 1923. Detachably mounted upon the faucet and may be readily attached or removed therefrom.

1,570,675. DYNAMO-ELECTRIC MACHINE; J. A. Johnson, Niagara Falls, N. Y. App. filed March 9, 1923. In which stator parts are cooled by circulation of air produced by the rotor, with means between the rotor and exposed portions of the stator windings substantially preventing the rotor from causing motion of air along or around the exposed portions of the stator windings circumferentially of the machine in case of a fire.

1,570,687. THERMAL SWITCH FOR ELECTRIC IRONS; J. N. Lewis, Detroit, Mich. App. filed April 29, 1922.

1,570,690. ATTACHMENT PLUG; S. McClatchie, Cambridge, Mass. App. filed July 3, 1920.

1,570,722. BATTERY TERMINAL; J. C. Baldwin, Junction City, Kan. App. filed Dec. 26, 1924. Protected with a solid covering to prevent corrosion.

1,570,723. INSULATOR; C. E. Banks, Monticello, Mo. App. filed July 12, 1921. Combined insulator and bracket which can be attached readily to the cross-arm or to the pole for carrying telephone and telegraph wires.

1,570,733. ELECTRIC TIME FUSE FOR BLASTING CARTRIDGES; W. Eschbach, Troisdorf, near Cologne-on-the-Rhine, Germany. App. filed July 12, 1922.

1,570,778. PORTABLE ELECTRIC STOVE; T. M. Putnam, Toronto, Ontario, Canada. App. filed Dec. 6, 1924. Of the type provided with a dished lower member having a central heating element and a dome support upon the dished member at its lower edge, to form a cooking chamber.

1,570,779. SHORT-CIRCUITING DEVICE FOR ALTERNATING-CURRENT MOTORS; H. G. Riebel and V. P. Sparks, Warren, Ohio. App. filed April 14, 1924. Used on single-phase machines.

1,570,789. ALTERNATING-CURRENT RECTIFIER; H. A. Seifke, San Francisco, Cal. App. filed Jan. 3, 1923. Wherein alternating current is fed to a commutator rotated in synchronism therewith and delivered from said commutator as direct current.

1,570,803, 1,570,804. METHOD FOR STARTING AN ARC IN A WELDING APPARATUS AND THE LIKE; F. L. Walker, Jr., Westwood, Cal. App. filed Feb. 9, 1925. By superimposing a high-voltage, high-frequency current of small amperage on the circuit containing the low-voltage source of energy for the purpose of causing the high-voltage current to jump across the gap under conditions which would not allow the low-voltage current to become active.

1,570,819. METHOD OF ELECTROPLATING AND APPARATUS THEREFOR; B. Bart, East Orange, N. J. App. filed Oct. 11, 1923. Providing for the handling of the articles in such way that all of the articles will have deposits of equal depth thereon or will be uniformly coated irrespective of variations in depositing activity at different portions of the bath, and in which it will be necessary simply to position the articles into the tank at one end thereof and remove the finished articles at the same or another point in the tank after each article has been subjected to a treatment for a prefixed and predetermined time while in the bath.

1,570,823. ELECTRIC SYSTEM; G. T. Bruun, Pittsburgh, Pa. App. filed Jan. 17, 1922. Means for preventing the main switch from being opened or closed while heavy current is flowing through it, as in the case of disconnecting switches.

1,570,827. ELECTRIC WATER HEATER; J. C. Feldman, New York, N. Y. App. filed Dec. 6, 1923.

1,570,864. ELECTRIC FUSE; G. H. Sinn, Spencer, Iowa. App. filed March 7, 1923. Adapted for the protection of polyphase motors, to prevent them from running single-phased. Fuse comprising a plurality of fuse strips, one for each phase of the circuit, each confined in an inclosing case and insulated from the others, portions of said strips being more or less closely associated together in a common fusing zone, to form a short-circuiting means whereby fusing of any one of the fuse strips will result in the rupture of the adjacent strip or strips.

1,570,911. MOTOR-CONTROLLING MEANS; B. E. Mills, Oak Park, Ill. App. filed Feb. 9, 1925. For use in controlling the speed of a bow-actuating motor for a stringed-instrument musical machine.

1,570,913. SNAP SWITCH; C. L. Moyer, Chicago, Ill. App. filed Oct. 23, 1924. In which the circuit-closing elements are biased toward open or "off" position and will automatically return to such position when the pressure upon the controlling element is released.

1,570,930. LIGHTING FIXTURE CONSTRUCTION; A. F. Wakefield, Vermilion, Ohio. App. filed March 18, 1925. Means provided in the fixture itself for adapting the fixture to proper-sized lamps, as in the case of kitchen lighting units.

1,570,933. CURRENT COLLECTOR; E. T. Bennington, Willoughby, Ohio. App. filed Sept. 5, 1924. As employed for conducting current from a conductor wire or rail to the operating motor of an electrically propelled vehicle as in various kinds of overhead carrier systems such as monorail, telphers and cranes.

1,571,104. THERMALLY ACTUATED DEVICE FOR CONTROLLING ELECTRIC CIRCUITS; P. W. Baker, Kingston-on-Thames, England. App. filed Sept. 25, 1923. Of the type adapted to be fitted to the lamp holder and in which the current is passed around a bimetallic bar or equivalent so as to heat it and cause it to bend and in doing so to break a circuit which is reclosed when the bar or equivalent cools sufficiently to return to its normal position. Used for the automatic switching on and off of lamps.

1,571,144. IRON FITTING OR BRACKET FOR INSULATORS; E. Saignol, Grangeneuve, St. Etienne, France. App. filed Oct. 28, 1924. Designed to be used with cross-arms, wherein the fitting is of double-hook formation to embrace the cross-arm and rigidly secured in connection therewith through the medium of a single bolt.

1,571,152. MOTOR-STARTING SWITCH; G. H. Whittingham, Baltimore, Md. App. filed Dec. 22, 1923. Distant control for starting induction motors, comprising connection with an electromagnetic starting switch for making proper connections of the motor windings for starting and a similar running switch for making the connections to said motor for normal running, a relay controlled by a push-button switch for closing the circuit of the magnet of the starting switch, said relay operating with a retarded action to open the circuit of said magnet when the starting current in the motor falls to a predetermined amount, and means controlled by the relay or by the starting switch for then closing the circuit of the magnet of the running switch.

1,571,165. REGULABLE ELECTRICAL STEAM BOILER; M. Fuss, Berlin, Germany. App. filed April 1, 1922. A device for the electric heating of liquids in combination with a boiler, a plurality of stationary electrodes suspended therein, a pair of vertically positioned insulating plates arranged about each electrode and forming a passageway there between, and means for rotating said plates whereby the cross-sectional area of said passageway may be varied at different points.

1,571,172. POTHEAD FOR ELECTRICAL CIRCUIT CONNECTIONS; P. F. Williams, Chicago, Ill. App. filed Aug. 5, 1918. Disconnecting type, which may be interchangeable, mounted either upon a pole or a cross-arm of a pole or upon a pipe or other upright tubular member.

(Issued Feb. 2, 1926)

1,571,182. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; T. E. Barnum, Wauwatosa, Wis., and E. R. Stoekle, Milwaukee, Wis. App. filed Feb. 25, 1922. Involving a vaporizable electrical conductor which is liquid at working temperatures; adapted to provide both overload and underload protection.

1,571,198. INDUCTION ELECTRICITY METER; J. Harris, Lafayette, Ind. App. filed Sept. 13, 1924. In which a thermostatic or thermo-motive element controls the position of a flux diverter with relation not only to the pressure flux threading the armature to maintain the volume of this flux constant upon change in temperature, but also to vary the portion of the pressure flux threading the phasing secondary coil or conductor to maintain the phase relation of the current and pressure fields upon change in temperature.

1,571,199. SYNCHRONOUS INDUCTION MOTOR; J. Harris, Lafayette, Ind. App. filed April 16, 1925. Employing an armature of non-magnetic metal revolving in inductive relation to a magnetic field produced by a winding which is preferably located upon a field core. Miniature type as used with instruments.

1,571,200. INDUCTION ELECTRICITY METER; J. Harris, Lafayette, Ind. App. filed May 20, 1925. Means for compensating for the temperature-effected changes in the flux of the drag or damping magnets thereof as well as the temperature-effected changes in the pressure flux.

1,571,209. SIGNAL SERVICE; W. S. Ludlow, Jr., Delhi, Ohio. App. filed July 24, 1922. For fire, emergency or patrol service.

1,571,224. MEASURING DEVICE; C. T. Allcutt, Pittsburgh, Pa. App. filed March 31, 1920. For measuring the symmetrical components of unbalanced polyphase quantities, whereby standard instruments and transformers may be used.

1,571,234. VOLT-AMPERE METER; F. Conrad, Pittsburgh, Pa. App. filed Jan. 20, 1922. A single self-contained translating device or dynamo-electric machine, similar to an ordinary motor, that is so constructed or wound as to permit the interconnection of the device and an ordinary wattmeter to an alternating-current circuit to measure effectively the volt-amperes of the circuit.

1,571,250. ARC EXTINGUISHING DEVICE; O. H. Eschholz, Wilkinsburg, Pa. App. filed Feb. 20, 1922. Arcing horns of such form that as the arc is moved away from its point of establishment, under the influence of blow-out coils or otherwise, gradually increasing resistance is introduced between the arc terminals and the spaced switch terminals and the arc stream thereby rendered unstable.

1,571,256. ELECTRICAL PROTECTIVE DEVICE; C. L. Fortescue, Pittsburgh, Pa. App. filed Aug. 9, 1920. For protecting the internal windings of electrical translating devices; shall be responsive to internal faults in electrical windings and responsive to zero phase-sequence currents.

1,571,262. ELECTRIC DISTANT-CONTROL SYSTEM; E. Granat, Paris, France. App. filed May 14, 1924. In which the rotation of the receiving element depends upon the rotation of the transmitting element in such manner that by placing the transmitting element in any one of a certain number of predetermined positions the receiving element will occupy in the like series of predetermined positions the one corresponding to the given position of the transmitter.

1,571,292. ELECTRICAL SWITCH FOR CAR DOORS; H. R. Meyer and L. G. Riley, Wilkinsburg, Pa. App. filed Sept. 23, 1921.

1,571,293. FLOW METER; C. M. Moss, Pittsburgh, Pa. App. filed May 19, 1922. Fluid-flow meter; electrically operated type such as is used to determine the total water consumption in hydraulic power plants.

1,571,303. DUPLEX AIR ROTOR; I. Schafran, New York, N. Y. App. filed May 15, 1922. Utilizing the principle that a propeller creates two forces in opposite directions. A pair of shafts are employed, to one of which a propeller is fixed. The thrust of the propeller results in rotation of the shaft. The other shaft carries a turbine disposed within the back stream of the propeller and adapted to utilize the same, whereby the turbine is rotated.